A

MILLION OF FACTS,

CONNECTED WITH THE

STUDIES, PURSUITS, AND INTERESTS OF MANKIND,

SERVING AS A

COMMON-PLACE BOOK

OF

USEFUL REFERENCE

ON ALL

SUBJECTS OF RESEARCH AND CURIOSITY.

COLLECTED FROM THE MOST

RESPECTABLE MODERN AUTHORITIES.

BY SIR RICHARD PHILLIPS.

SECOND EDITION.

REVISED, CORRECTED, AND IMPROVED WITH ADDITIONS.

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PREFACE.

TO THE

AMERICAN EDITION.

The following Part, containing "A Million of Facts, is based on the English book of that title, from the memoranda of one of the oldest scholars and publishers of that country; but has been in a measure remodelled here. All that part relating to Religion has been omitted, as also the Mythology. The Geography, with the numerous tables of Statistics, having been anticipated in the former Parts of the Treasury of Knowledge, it was thought needless to bring them forward again.

In the place of the matter excluded, the publishers have obtained from Samuel L. Knapp, Esq., a sketch of the Literature of the Jews; a succinct History of American Literature, from the earliest times, giving a sketch of some of the most important writers and their works; and also brief annals of American History, with a cursory view of the rise and progress of the Useful Arts among us: other incidental facts as they came to the mind of the author, which he thought might be acceptable to the miscellaneous reader, have been added. The additions to this part have been written in paragraphs, with as much variety as possible, and in a style conformable to that assumed by the English writer.

In a Book of Reference, as this part of the Treasury of Knowledge especially is, the reader only asks for purity and clearness, and these, it is believed, will be found as distinctly in the additions, as in the other parts of the book.

That portion of the work under the head of "Atmospherical and Aerial Phenomena," has been revised by Mr. Wm. C. Redfield, and many interesting facts have been added which are not found in the Encyclopædias and other Standard Works. The articles under the head of "Physical Geography," have been prepared by the same hand.

Such a volume may be taken up as matter of amusement when the reader has but a few minutes to spare, and some valuable facts may be stored in his memory for future contemplation and use. When one becomes acquainted with the scraps and notes contained in "The Million of Facts," he will be surprised to find many things that he has been years in search of, and could not tell where to lay his hand on them. The fields of knowledge are now so extended, and so crowded, that the most industrious in the pursuit of information will be thankful for indices, and directories in his course.

The Bibliotheca Britannica, is now considered the greatest book in the libraries of the learned. These ponderous volumes give at a glance the book and the writer, or the writer and the book; this is to the seeker of knowledge, what the wisdom of Daniel was to the king of Babylon, when he told him what he had dreamed, and the interpretation he sought; for, where some vague thought of former reading is resting in the twilight of recollection, and not one of the wise men, the magicians, astrologers, or Chaldeans around him, can make known what is wanted, or where it may be found, this Bibliotheca Britannica does both: for, you may find any author or work, upon almost every subject in every age of literature. This book occupied and exhausted the labours of two gentlemen, father and son, who died before their work was perfected; and it remains for one of the third generation to complete it. This part of "The Treasury of Knowledge" will, if countenanced by publick patronage, in matters of fact in all the branches of human learning, be in some measure what the Bibliotheca Britannica is to authors and their works, and it may be continued to almost any extent that the publick may require.

THE PUBLISHERS

N. B. The Publishers, impressed with the value of the accompanying work of Facts in the pursuits of life, and being desirous to extend its usefulness to those who do not feel disposed to purchase it as connected with the Treasury of Knowledge and Library of Reference, of which it forms the Fifth part, have concluded to offer it to the publick in a separate volume, which they trust will meet with their approval.

ADVERTISEMENT.

FACTS are the data of all just reasoning, and the primary elements of all real knowledge. The wisest man is he who possesses the greatest store of Facts within the command of his understanding. A book, therefore, which assembles Facts from all their scattered sources, may be considered as a useful and important auxiliary of Wisdom. It lays claim to be the companion of ALL who earnestly seek truth at the fountain-head; of ALL who think for themselves, or who desire to be thought to do so; and of ALL who desire to correct errours in themselves or in others.

The pretensions of the present Editor are a prolonged and uninterrupted intercourse with men and books. He has for forty-two years been occupied as literary conductor of various publick journals of reputation; he has superintended the printing of some hundred books, in every branch of human pursuits; and he has been intimately mingled with men celebrated for their attainments in each of them.

This work will however be variously estimated by different persons in sympathy with their favourite pursuits. Every one will expect more on his own subject than the execution could permit. Portable size, moderate price, and generalizations were its essential elements. If larger, more costly, or more detailed on particular subjects, it would not have been, as designed, a book of UNIVERSAL UTILITY.

The class of facts have generally been preferred which bear the modern name of statistical, since numbers are the least remembered, and therefore, in regard to them, an auxiliary is the most required. But a succession of such details would have been intolerably dull, and the Editor has, therefore, intermingled them with facts more piquant to the imagination, so as to produce a diversity of information that may often be perused with pleasure in uninterrupted succession.

For the same reason, logical analysis and synthesis have been avoided, and order, as such, disregarded, except in the juxtaposition of similar topicks, and the arrangement into chapters. A readable Book of Facts was the object, and it is to be hoped that the execution has been such as is best suited to its attainment.

In its nature the book is not one of opinion or doctrine. Some subjects, however, have extorted inferences, the withholding of which would have been to compromise truth, and exhibit a coldness of feeling little creditable to the Editor.

On the Title of the work it may be remarked, that, though it limits the contents to a MILLION of facts, yet, in truth, the volume, directly or indirectly, contains FAR MORE. It is not pretended, however, that it contains all facts, since facts are infinite in number, but only such as best illustrate the subjects, and as are the most likely to become objects of inquiry and reference. Million, in this sense, is like the Hebrew word forty, meaning a number undetermined, and either a million, or forty, more or less. No generick word like collection, assemblage, multitude, &c. so aptly expressed the comprehensive extent of the work as the word million; for, besides its literal truth, it implies that the book may be used in a million of cases of inquiry, and further, that it has claims to be received, in due time, into a MILLION OF FAMILIES.

Kensington, March 14, 1832.

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THE

BOOK OF FACTS,

OR,

UNIVERSAL COMMONPLACE-BOOK.

MEASURES OF CAPACITY.

Measure is length, breadth, and thickness, estimated by known lengths, or compared by other known quantities: thus there are 12+12+12 =1728 cubick inches in a cubick foot; and 3×3×3=27 cubick feet in a cubick yard.

The *Imperial gallon* is 277.274 cubick inches. A gill, or quarter of a pint, is 8⅝ inches.

The Imperial gallon contains 10 lb. avoirdupois of distilled water, weighed in air, at 62°, with the barometer at 30 inches. Two gallons a peck, eight a bushel, and eight bushels a quarter.

One English wine gallon is equal to .0833111 Imperial gallon.

One ale gallon=1.017045 Imperial.
One corn bushel=0.96943 Imperial.
One Imp. gallon=1.20032 wine gall.
One Imp. gallon=0.933241 ale gall.
One Imp. gallon=1.03152 corn gall.

An Imperial gallon is 4.843452 litres.

Heaped measure, per bushel, is 2815¼ cubick inches clear.

The standard bushel kept at Guildhall contains 2145.6 cubick inches of water, weighing 1131 oz. 14 dwts.

The Winchester bushel is 18½ inches diameter and 8 inches deep, containing 2150.42 cubick inches.

A quarter of corn is the fourth of a ton, and eight bushels, or two sacks.

A strike is four pecks.

1000 ounces of rain water are equal to about 7½ gallons wine measure, or to a cubick foot.

71b. avoirdupois is a gallon of flour.

A chaldron of coals is 58⅝ cubick feet.

Twelve wine gallons of distilled water weigh 100 lbs. avoirdupois.

Nineteen cubick inches of distilled water at 50°, weigh 10 oz. troy.

A cubick inch of distilled water at 62°, in a vacuum, is 252.724 grains.

The Imperial measure for heaped goods contains 80 lbs. avoirdupois of distilled water, and is 19½ inches from outside to outside at the bottom; the heap to be in a cone at least six inches high from the outside: three making a sack and twelve sacks a chaldron, which ought to weigh 28 cwt.

The Imperial dry bushel, when not heaped, is 2218.192 cubick inches; the peck 554.548; gallon 277.274, and quart 69.3185. The bushel is 8 inches deep, and 18.8 wide; with a heap 6 inches high.

A tun is 2 pipes, 4 hogsheads, 3 punchcons, 8 barrels, or 252 gallons. A pipe of port is 138 gallons; of Lisbon 140; Maderia 110; and Sherry 120. The hogshead of Claret is 57 gallons, and the aum of Hock 36 gallons; Teneriffe 120, and Cape 20.

A tun of wine is 2 pipes, and each pipe 2 hogsheads of 63 gallons.

A tun of beer is 2 butts, and each butt 2 hogsheads of 54 gallons.

A bushel of wheat is 60 lbs., rye 53, barley 47, oats 88, peas 64, beans 63, clover seed 68, rape 48 lbs.

53 cwt. is a chaldron at Newcastle. A keel of 8 Newcastle chaldrons is 15½ London chaldrons.

The Imperial corn bushel of 2218.192 cubick inches, is to the Winchester of 2150.42, as 32 to 31.

The Imperial coal bushel of 2816.459 inches, is $1\frac{1}{2}$ inches more than the old coal bushel of 2814.9.

The Imperial wine measure is to the old measure as 6 to 5; 5 imperial gallons being 6 wine gallons and $\frac{1}{4\,5\,0\,0}$th over.

The new and old ale measures are as 60 to 59.

To convert old corn measure into new, multiply by .96943 or $\frac{3\,1}{3\,2}$; wine by .83311 or $\frac{5}{6}$; ale by 1.01704 or $\frac{5\,0}{6\,0}$.

Wood, the fuel of France, is sold by the corde of 576 square feet; and 80 square cordes make what is called a journal.

At 70° the specific gravity of water is 0.99913; at 38° is 1.00113; and at 54° is 1.00064. The difference between 62° and 39° in a gallon of 277.276 inches, is one-third of a cubick inch.

A last is a commercial measure, of twelve barrels of soap, ashes, herrings, &c.; ten quarters of corn, or two cart loads; twenty-four barrels of gunpowder; twelve sacks of wool; and 1760 lbs. of flax or feathers.

A Scotch pint is four English pints.

A Scotch pint is 105 cubick inches, and a wheat farlot $21\frac{1}{4}$ Scotch pints.

The Scotch quart 206.8 cubick inches.

A tub of butter is 84 lbs. and a firkin 56 lbs.

A Scotch boll is an English sack.

A soldier's canteen contains three pints.

The *litre* is 61.0279 English cubick inches, or $2\frac{1}{8}$th wine pints.

The *stere*, or cubical metre, is 35.3171 cubick feet English.

There are 5452670000 cubical yards in a cubick mile.

A Roman quadrantal was a cube containing 80 lbs. of water, or 48 sextaries and 8 congii. A gower was 7 pints.

The *Ephah* was the sixth part, or 1747.7 cubick inches, nearly an English cubick foot.

The Winchester bushel is 35.2466 litres. The stere is 35.317 cubick feet.

WEIGHTS.

Weight is the tendency or force with which bodies of various density tend to fall towards the earth.

The standard of weights is the cubick inch of distilled water, weighing 252.458 troy grains; the troy pound 5760 grains, or 22.8157 inc. The same standard of 7000 troy grains makes the pound avoirdupois, 27. 7274 cubic inches: ten of which, or 277.274 being the Imperial gallon; a quart 69.32; and a gill, of 5 oz. of water, equal 8.664.

In Troy Weight, 24 grains make a pennyweight, (meaning grains of wheat) 480 an oz. and 5760 a lb.; or 20 dwt. an oz. and 12 oz. a lb.

In Apothecaries' Weight, 20 grains make a scruple, 60 a drachm; and then as in troy weight, 480 make an oz., and 5760 a lb. There are 12 ounces to the lb., 8 drams to an ounce, 3 scruples a dram, and 20 grains or drops to a scruple. The dram is 60 grains.

In Avoirdupois Weight, 16 drams make an oz. 256 a lb.; 16 oz. a lb.; 112 lb. a cwt.; and 20 cwt., or 2240 lbs., a ton.

175 lbs. troy are equal to 144 lbs. avoirdupois; and 175 oz. troy are equal to 192 oz. avoirdupois.

80 oz. avoirdupois are equal to 73 oz. troy; and 14 lbs. avoirdupois to 17 troy. A troy pound is 13 oz. 2.65 drams avoirdupois; and a lb. avoirdupois is 1 lb. 2 oz. 11 dwt. 16 grs. troy.

The avoirdupois lb. of 7000 grains is 453.61 French grammes; and the troy lb., 5760 grains, is 373.14 grammes.

One troy lb.=0.822857 Imperial lb.

One Imp. lb.=1.215271 lb. troy.

Henry III. enacted that an ounce should be 640 dry grains of wheat; 12 oz. a lb.; 8 lbs. a gallon of wine; and eight gallons a London bushel. Latterly, the malt liquor measure has been 282 inches to the gallon, and the wine measure 231.

7000 grains of water, thermometer

62 degrees, and barometer 30 inches, are 1 lb. avoirdupois.

The French gramme is 15.434 English grains.

The smaller French weights are in tenths, decreasing, as *deci*, *centi*, and *milli grammes*.

The larger are *deca*, *hecato*, *chilio*, and *mirio grammes*, in tenths, increasing.

The kilo-gramme, or 1000 grammes, is equal to 2 lbs. 2 oz. 4 grains avoirdupois.

In Greece, a drachma was 2 dwt. 16 grains; a minæ 1 lb. 1½ oz.; a talent 67 lbs. 7 oz. 5 dwt.

The Roman weights were the As, equal to twelve ounces, and the uncia an ounce.

The American quintal is 100 lbs.

The Mysore cutcha seer is 9 oz. 11½ drams.

A bale of Egyptian cotton is 90 lbs., of Brazil 160, of Georgian and Sea Islands 280, Orleans 300, East India 300, West India 350 to 400.

A pack of sheep's wool is 240 lbs.

The livre, or French pound, is 500 grammes, or 7714 grains English, or 1 lb. 1 oz. 10⅕ drams avoirdupois. The quintal, of 100 kilo-grammes, is 220.486 pounds.

The Bengal maund is 74 lbs. 10 oz. 10⅔ drams avoirdupois; the seer 1 lb. 13 oz. 13.866 drams; the chattock 1 oz. 13.366 drams. The Baza maund is 82 lbs. 2 oz.

A seam of glass is 24 stone of 5 lbs. each.

The weight of a cubick inch of distilled water, in a vacuum is 252.722 grains; and in air is 252.456 grains.

The quintal is ten mirio-grammes, or 2 cwt., or 224 lbs., English, nearly.

A sack of wool is 22 stone of 14 lbs. or 308 lbs. In Scotland, it is 24 stone of 16 lbs.

A pack of wool is 17 stone 2 lbs., or a horse load.

A tod of wool is two stone of 14 lbs. each; and a sack is 13 tod; 12 sacks is a last, or 4368 lbs.

56 or 60 lbs. is a truss of hay, old or new, and 40 lbs. a truss of straw; 36 trusses being a load.

A Spanish quintal is 312 Spanish lbs. The arroba is 25 Spanish lbs., of 6544 grains each; and 6 arrobas make a quintal.

The Portuguese arroba contains 32 Lisbon lbs. of 7005 grains.

The Venetian mirre contains 30 lbs. of 4215 grains.

The Shippondt of the northern nations is, in Sweden, for copper 320 lbs. of 9211 grains, and for provisions 400 such lbs. At Riga it is 400 lbs. of 6149 grains. At Hamburgh 300 lbs. of 7315 grains.

100 lbs. English is equal to 112⅔ lbs. of Russia, to 93 lbs. 5 oz. of Hamburgh, and to 132 lbs. 11 oz. at Leghorn, and 104 lbs. 13 oz. in Portugal, and 91 lbs. 8 oz. at Amsterdam.

The commercial lb. of Amsterdam is 7636 grains, and the troy lb. equal to 7602 grains. The Dutch stone is 16 lbs. The Norway lb. is 7833 grains. The Spanish lb. is 7038 grains. The Chinese kin is 5802 grains, or 375 $\frac{2}{10}$ French grammes.

The Turkish lb. is 7578 grains. The Danish 6941. The Irish 7774. The Naples 4952. The Scotch lb. troy 7620.8. The Smyrna lb. 6944.

A cubick foot weighs—

Of loose earth or sand	95 lbs.
Of common soil	124
Of strong soil	127
Of clay	135
Of clay and stones	160
Of mason's work	205
Of distilled water	62.5
Of pure gold	1203.625
Of pure silver	654.8
Of cast iron	450.45
Of steel	489.8
Of lead	709.5
Of platina	1218.75
Of copper	486.75
Of cork	15
Of Portland stone	157.5
Of tallow	59
Of oak	73.15
Of brick	125
Of crown glass	160.75
Of fir	34.375
Of mahogany	66.4
Of air	0.0753

MEASURES OF LENGTH.

Measures in length are the distance of one object from another in some agreed standard.

A line is the 10th of a digit, and the 100th of a foot.

A *digit* measure is $\frac{3}{4}$ths of an inch, or 4 barleycorns laid breadthways.

A hair's breadth is the 48th of an inch.

A barleycorn is .00217th of a cubick inch, or about 460 make a cubick inch, or 3 to an inch in length.

A geometrical *pace* is 4.4 feet English; and an English mile contains 1200, or 1760 yards, or 5280 feet.

The Paris foot is nine lines shorter than the English foot, or 0.91 to 1.

The Roman foot was 0.915.

The Rhinland or Leyden foot is 0.86925 English

A *Scotch* mile contains 1500 paces.

A *German* mile 4000. A Swedish and Danish mile 5000. The Russian mile 750 paces.

A great league in France is 3000 paces, and a mean league 2500.

A nautical league is $\frac{1}{20}$th of a degree.

A *hand* used for horses is 4 inches.

A degree of latitude is 69$\frac{1}{7}$ English miles at the equator.—*Mudge.*

A nail's breadth is the 16th of a yard, or 2$\frac{1}{4}$ inches.

A surveyor's chain is 4 poles, or 66 feet, divided into 100 links of 7.92 inches. A square chain is 16 poles, and 10 square chains are an acre.

640 acres are a square mile; and 4840 square yards are an acre, 169.58 yards each way.

The Irish acre 7840 square yards.

A French *arpent* $\frac{5}{6}$ths of an English acre.

The Scotch acre 1.27 English.

121 Irish acres are equal to 196 English.

48 Scotch acres are equal to 61 English.

11 Irish miles are equal to 14 English.

80 Scotch miles are equal to 91 English.

The Turkish dreah, or pik, is 3 palmi, or 26.41 inches, and the lesser pik is 19.03 inches.

The jaghire is 10.46 English inches. A cawney is rather more than an acre.

A hide of land was one plough's work.

An ox-gang is 15 acres, or as much as one ox can plough in a year.

The long-line adopted in the navy is 48 feet.

A sea league is 3.4536 miles, or the 20th of a degree.

6078 feet are a sea mile.

A palm is 3 inches. A fathom 6 feet.

The French metre is 36.9413 French inches, or 39.371 English, or 3.2389 feet.

In Greece, a digit was $\frac{3}{4}$ths of an inch, a cubit 13$\frac{1}{2}$ inches, and a large cubit 18$\frac{1}{3}$ inches; a pace 2 yards and $\frac{1}{2}$ an inch, a stadium 201 yards 1 foot 3$\frac{2}{5}$ inches; 8$\frac{3}{8}$ stadia a mile nearly. The plethron, 10000 square feet.

A Bengal coss is 6000 feet, or 1 mile 240 yards.

The haut or cubit is 18 inches.

A baggah of land is 1600 square yards, about a third of an acre.

A span was 10.944 inches.

Ezekiel's reed was 10 feet 11$\frac{1}{3}$ inches.

A sabbath day's journey was 1155 yards, or about $\frac{2}{3}$rds of a mile. A day's journey was 33$\frac{1}{4}$ miles.

The Egyptian cubit, or ardub, was 21.888 inches.

The *Greek* foot was 12$\frac{1}{2}$ inches.

The Hebrew foot was 1.212 English feet. The Hebrew cubit 1.817; the sacred cubit 2 English feet; and the great cubit 11 English feet.

The stadium, 625 feet; and the milliarium, 5000 feet.

The Amsterdam foot is .927; and the ell 2.233.

The Berlin foot .992

The Bologna foot 1.25.

The Brabant ell 2.268.

The Brussels foot .95.

The Chinese imperial foot 1.05.

The Chinese lis is 629 yards.

The Turkish foot 1.165.

The Florence foot .995.

The Geneva foot 1.919.

The Hamburgh foot .933.

The Italian mile 5299 feet.

The Portugese foot .952.

The Madrid foot .915.

The Moscow foot .928.

The Neapolitan mile 4 German miles, or 60th of a degree.

The Roman palm .733.

The Roman foot .966.

The Roman mile $\frac{1}{75}$th of a degree.

The geographical or Italian mile is 1000 geometrical paces, or $\frac{8}{9}$ths of an English mile.

The Roman *braccio* is 4 palms.

The *cauna* 8 palms.

The Russian *werst* is 3508 English feet, about $\frac{2}{3}$ds of a mile.

The Scotch ell is $37\frac{2}{10}$ inches.

The Scotch mile 5952 feet.

The Spanish league 4 miles English.

The Swedish foot 1.073 English feet.

The Venice foot 1.14.

The Venice ell 2.089.

The Vienna foot 1.036.

The Vienna post mile 24888 feet.

The Wirtemburg foot 11.28.

The Levant pig is $\frac{3}{5}$ths of the French ell. The Venetian ell is $1\frac{8}{15}$ths of the French ell.

The candi, of India, is equal to the Venetian ell. In Siam, the ken is 36 inches nearly, and is divided into 2 soks; these into 2 keubs; and each keub into 12 nions, at $\frac{3}{4}$ths of an inch.

3 inches is a palm: 3 palms, or 9 inches, a span. 5 feet is a pace. 2 yards is a fathom.

The German mile is the 15th of a degree of latitude, or more than $4\frac{1}{2}$ miles English.

A league is 3 sea miles. 17 Spanish leagues is a degree, or about 4 miles, which is the Dutch and German league. The Persian league, or parasang, is 30 stadia or furlongs.

The Paris *line* .0888.

The Paris *ell* 43.9 inches.

The French *toise* 6 feet 4.733 inches.

A French *league* $\frac{1}{25}$th of a degree.

The French *metre* 39.37079 inches. The metre is 443.2959 lines, and .513074 of a French toise. 8 chiliometres is about 5 miles English. 1000 feet is nearly 305 metres.

The *metre* is the ten millionth part of the quadrant of the earth from the equator to the north pole. It differs slightly from the length of a pendulum which, in the latitude of London, vibrates seconds in a vacuum, at the level of the sea, where it is 39.1393 inches; therefore, the metre is only .23 of an inch longer than our pendulum.

The *millemetre*, or thousandth part, .03937 inches English.

The *centimetre* .39371.

The *decimetre* 3.93708.

The *decameter* is ten times the *metre*.

The *hecatometre* 100 times.

The *chiliometre* 1000 times; and the *miriometre* 10,000 times.

The *are* is 3.95 English perches.

An inch English is 2.54 centimetres; a yard is 0.91438 metres; and a mile is 1609.3149 metres.

The French metre is the ten millionth of a quadrant of the earth, taken as 6217.857 English miles, or 32809167 feet, and a mean degree of latitude at 69.0429. A centesimal degree is 54 minutes. A league at 25 to a degree is 2.7617 miles. A post league 2000 toises, or 2.3 miles English; a toise being 6 feet $6\frac{3}{4}$ inches English. The pied one-sixth of the toise; and the aune 3 feet $11\frac{1}{4}$ inches English.

A degree at the equator is 365101 feet, or 69.148 miles, or $69\frac{1}{7}$ nearly. In latitude 66.20 Maupertius measured a degree of latitude, in 1737, and made it 69.403; and Swanberg, in 1803, made it 69.292. At the equator, in 1744, four astronomers made it 68.732; and Lambton, in lat. 12, 68.743. Mudge, in England, makes it 69.148. Cassini, in France, in 1718 and 1740, made it 69.12, and Biot 68.769; while a recent measure in Spain makes it but 68.63, less than at the equator; and contradicts all the others proving the earth to be a prolate spheroid, which was the opinion of Cassini, Bernouilli, Euler, and others, while it has more gene-

rally been regarded as an oblate spheroid.

Degrees of longitude are to each other in length, as the cosines of their latitudes. For every 10° they are as follow:—

Equator, .	69.2
10° . . .	68.15
20 . . .	65.27
30 . . .	59.93
40 . . .	53.1
50 . . .	44.48
55 . . .	39.69
60 . . .	24.6
70 . . .	23.67
80 . . .	12.02

The diameter of the equatorial circle is 41837494.8 feet; and its circumference 131436444 feet, which, in a sidereal day, gives a velocity of 1525 feet per second of rotation.

Then $1525 \times 4 = 6100$ for the velocity of the surface of the whole sphere, which, $\times$ 16.08728, the mean force per second, gives 98132 feet per second for the orbit velocity of the earth; and this multiplied by 31558151 seconds in a sidereal year, gives a mean orbit of 586527362.6 miles; and a mean radius, or distance from the earth to the sun, of 93348800 miles. The aphelion distance is 94918500 miles, and the perihelion 91779000.

The pendulum which vibrates seconds 39.1393 inches at London, is the standard for the British measures. 1 mile is equal to 1618.833 such pendulums.

MEASURES OF TIME.

Time is best defined as the succession of motion and phenomena, independent of relative human perceptions.

Time is measured by man by the impressions of successive ideas, and these diminish in a ratio of their own increase; consequently, time appears less as men advance in age, or are variously employed. At ten, a year seems to be twice as long as at twenty; three times as at thirty; four times less at forty; five times at fifty; and six times at sixty: circumstances of employment and position being the same. Hence a month employed in travelling seems equal to three of usual pursuits. Time being mentally measured by the impressions of new ideas.

Absolute time, independent of the feelings of individuals, is measured by certain regular motions, as the rotation of the earth, the swing of a pendulum, the fall of a body, the revolutions of the moon round the earth, or the earth round the sun.

The *tropical* year is 365 days 5 hours 48 minutes 51.6 seconds; but the *sidereal* year, or return to the same star is 365 days 6 h. 9 m. 11°; but as the line of apsides or aphelion point advances 655 seconds, the orbit is completed in 365 days 6 h. 15 m. 20 s., and this is called the *anomalistick* year.

The Chaldeans made the sidereal year 365 days 6 h. 14 m., or one minute 49 seconds more than our present year, and the tropical year 365 days 5 h. 49 m. 30 s., being 38 m. 4 s. more than ours.

If Hypparchus was right in his measure of the tropical year, it is 11. 2″ less than in his time. The Brahmins made it 1 m. 43 s. more than now.

The precession of the equinoxes is performed in 25868 years; and the revolution of the line of apsides in 20931, or one deg. 43 m. 10″ in a century. The precession of the equinoxes, is 50′ 25″ per annum, or 1° 52′ 45″ in a century, or the 360° in 25868 years.

Leap year is the year which divides evenly by four; but the year 1900 will not be leap year, to make up for the odd minutes gained between the astronomical and computed year, as 365 days.

The astronomical equinoxes are on the 21st of March and 21st of September, and the sun is in the tropics on the 21st of December or June. Quarter days in civil reckoning are March 25, June 24, Sept. 29, and Dec. 25, being festivals of the Catholic Church.

The Synodical lunar month of her departure from the sun's centre to the return, or from full to full, is 29 days 12 hours 44 m. 12 s., and was the universal month of the ancients, twelve being accounted a year.

The difference between the solar and lunar year is $10\frac{1}{2}\frac{9}{2}\frac{7}{5}$ days.

The sun and moon return to the

same relative positions every 223 lunations; according to the ancient Chaldeans in 6585 days 8 hours. Our modern tables make it 17.29″ less.

The Eastern nations, where the day varies little, reckon the day from sunrise. The Romans reckoned as we do, from midnight.

Christian nations assign thirty days to April, June, September, and November, thirty-one to other months, and twenty-eight to February, making three hundred and sixty-five; but three hundred and sixty-six in Leap-year, when February is twenty-nine.

The Romans added the day in Leap-year on the sixth of the calends of March, making two *sixths* or *bis sextus*, and hence the word Bissextile.

The *astronomical* day is the time which elapses from the sun's being on the meridian of a place till his return, divided into twenty-four hours of sixty minutes. And astronomers begin the day at the departure of the sun from the meridian of the place, counting twelve hours till midnight, P. A. or after; and twelve hours from midnight till noon A. M. or before: their day after twelve at night being a day later than *civil reckoning*, which begins a new day at twelve at night, and reckons from twelve at night to twelve the next night.

As the earth advances in its orbit 61′ 9.9″, when in its perihelion, and only 57′ 10.7″, when in its aphelion, while it returns the same meridian to the sun, that meridian arrives at the same *fixed* star in twenty-three hours 56′ 41″ or 3′ 559″ less; others make it twenty-three hours 56′ 34″ and 3′ 56.6″.

Sidereal days are always the same, and accord with a true clock; but owing to the unequal velocity, as expressed, of the earth in its orbit in the perihelion and aphelion, the sun's return to the meridian varies; and also as the earth's path is inclined to the axis of rotation, the solar days vary. Owing to the first cause, the extreme difference is 7′ 39″ on March 21, and 6′ 5″ on May 6; 0 on July 1, making the sun slower than the clock; but owing to the obliquity it is 0 on March 21; 9′ 53″ on May 6th, and 0 June 22, making the sun faster than the clock. The combination of both causes produces the table of equation of time by which true clocks ought to be kept faster or slower than the meridian sun or a sun dial, called *apparent* time, and the other true or mean time.

As the earth moves forward in its orbit 59′ 8.3″, while it turns on its axis, any place arrives at a fixed star 3′ 56. 6″, before it arrives again at the centre of the sun, called twenty-four hours; hence the sidereal day is but 23 h. 56′ 3.4″, which is the real period of revolution.

Hence, in 365 solar days, the earth turns 366 times on its axis, and by this exact quantity it gains in its orbit with reference to the sun and stars in every revolution, and hence the precession of the equinoxes. For as the orbit is caused by the sun, and the equinoxes have reference to the sun and not to the stars, so the equinoxes fall back 24,890 miles, or in space 50.3″, with reference to the stars. Every other body like the earth turns once on its axis by going round a central body, and this therefore is the sole cause of the equinoxial points.

The Chaldeans, Egyptians, and Jews, began their civil year from the autumnal equinox. The Persians, Greeks, Romans, and the English till 1752, began the year at the vernal equinox. Thence to make dates agree with those of other nations, between January and Lady-day, our writers used to put two dates, as

Feb. 10, $\frac{1708}{1709}$ The bottom date being from Jan. 1, and the upper that from the previous Lady-day.

Sidereal days are always 23 h. 56′ 3.4″; but as the axis of the earth is inclined to the orbit, and the earth moves faster in the winter than in the summer, the clocks which measure equal time do not agree with the sun. A clock and a sun dial will therefore vary as under.

March 21, clock too fast 7′ 35″; April 5, do. 2′ 55″; April 20, June 13, Sept. 5, Dec. 25, they are equal. When the sun is in Libra and Scorpio, or in October and November, the difference is from ten minutes to 16′ 18″, and the clock ought to be so much faster than the dial.

The difference of velocity makes the dial faster than the clock, while

the earth is moving from its perihelion on January 1, to the aphelion July 1; and on the contrary, the dial is slower from July 1 to January 1. But the obliquity makes the dial faster from March 21 to June 22; and from Sept. 22 to Dec. 21, and slower from June 22 to Sept. 22, and from Dec. 21 to March 21. The union of both produces the common equation table as under, showing to the nearest minute how much a true clock should be faster or slower than the sun.

Months.	Days.	Equ. in Minutes.		Months.	Days.	Equ. in Minutes.	
Jan.	1	4	Clock faster than the Sun.	Aug.	9	5	Clock faster.
	3	5			15	4	
	5	6			20	3	
	7	7			24	2	
	9	8			28	1	
	12	9			31	0	
	15	10					
	18	11		Sept.	3	1	Clock slower than the Sun.
	21	12			6	2	
	25	13			9	3	
	31	14			12	4	
Feb.	10	15			15	5	
	21	14			18	6	
	27	13			21	7	
Mar.	4	12			24	8	
	8	11			27	9	
	12	10			30	10	
	15	9		Oct.	3	11	
	19	8			6	12	
	22	7			10	13	
	25	6			14	14	
	28	5			19	15	
Apr.	1	4	Clock faster.		27	16	
	4	3		Nov	15	15	Clock slower than the Sun.
	7	2			20	14	
	11	1			24	13	
	15	0			27	12	
					30	11	
	19	1	Clock slower.	Dec.	2	10	
	24	2			5	9	
	30	3			7	8	
May	13	4			9	7	
	29	3			11	6	
June	5	2			13	5	
	10	1			16	4	
	15	0			18	3	
					20	2	
	20	1	Clock faster.		22	1	
	25	2			24	0	
	29	3					
July	5	4			26	1	Faster
	11	5			28	2	
	28	6			30	3	

The PENDULUM for true and exact measuring of time was a suggestion of Galileo, in consequence of his observing the oscillations of a chandelier in a cathedral. Every oscillation, whether long or short, of the same pendulum, is performed in the same time. A pendulum which vibrates seconds at London, ought to be 39.139 inches nearly, and the length of pendulums for less or greater times is as the square of the times: thus, for half a second it would be the square of $\frac{1}{2}$, or $\frac{1}{2} \times \frac{1}{2} =$ $\frac{1}{4}$; so that $\frac{39.139}{4} = 9.78425$ inches is the length of a half second's pendulum at London.

At St. Thomas', in lat. 25′, the second's pendulum is 39.02069; and at the Gallipagos, in lat. 0° 32′, it is 39.01717 inches.

At Maraham, in 2° 32′, it is 39.01197.

Hence Capt. Sabine calls the equator 39.0152 inches, and he calculates it to be at the Poles 39.21765; considering the ellipticity as 289.1; which La Place makes 306.75.

The highest latitude yet taken is 79° 50′, and here it is 39.21464. At Greenland in 74° 32′, 39.20328; at Hammerfest, 70° 40′, 39.19512; and at Unst, in the Orkneys, in 60.45, it is 39.17145.—*Biot.*

At Paris, 48° 50′, it is 39.12843; at London, 51° 31′ 39.13908; and at Bordeaux, 44° 50′ 39.11282; and Clermont, lat. 45° 47″, 39.11313, giving 39.11813 for the mean latitude of 45°, which Sabine makes 39.11654.

A body therefore falls at the equator in a second of time 16.045258 feet; in the lat. of 45° per Sabine 16.08645; at London, 51° 31′, in 16.0963; and at Paramatta, in 33° 48′, 16.0703 feet; or per mean as above 16.08728.

The time of a complete oscillation in a cycloid is to the time a body would fall through the axis, as 3.1416 to 1. Then the fall of a body in a second is 3.1416^2, $\times$ half the length of a pendulum which vibrates seconds.

CHRONOMETERS, for nautical and astronomical purposes are now made with such precision, that they do not vary from true time more than two or three seconds in a year, or, in other

words, they are as perfect as any instrument by which observations can be made on the heavenly bodies. The 20,000*l.* offered by the Board of Longitude was given to Harrison.

The best watches and timepieces are made in London, but many at Liverpool and Coventry, also at Paris and Geneva. The first decided improvements were by Harrison, Arnold, and Earnshaw, each of whom received rewards from the Board. Brequet is the most skilful maker of nautical timepieces in France. There are from two to three hundred master watch and clock makers, employing three or four thousand hands in the parishes of Clerkenwell and St. Luke's, on the north side of London. A single watch passes through fifty different hands. The movements are chiefly made at Prescot, in Lancashire.

The extreme variation of two watches at Greenwich in 12 months, was from .9″ to 2.8″ in a temperature from 39° to 82°.

As the earth of 360 degrees of longitude turns in twenty-four hours, every hour of sixty minutes of time, is equal to fifteen degrees, and every degree equal to four minutes of time, every minute of time equal to $\frac{69.748}{4}$ = 17.287 miles at the equator, or 1525 feet per second. Degrees of longitude in different latitudes are as 1000 : to the cosine of the latitude : : 69.148 : length of degree. The cosine of five degrees is 996; of 10°, 985; of 15°, 966; of 20°, 940; of 25°, 906; of 30°, 866; of 40°, 766; of 45°, 707; of 50°, 643; of 51°, 31′, 622; of 60°, 500; of 70°, 342; of 80°, 174; and of 85°, 87; consequently, for 51.31, the latitude of London, 69.148 × 622 and ÷ by 1000, gives forty-three miles for a degree of longitude; and therefore $10\frac{3}{4}$ is equal to a minute of time in this parallel.

In India a day is divided into 60 Ghurries, a Ghurry into 60 Puls, a Pul into 60 Prans, and a Pran into 10 Tas, in 2-5ths of a second.

The beats in an hour of a common second's clock are 3600, and 17280 a common watch; but second watches beat 18,000 times, or 5 per second.

A luminous point to produce a visual circle must go round seven times in a *second*.

Fewer than 30 vibrations in a *second* give no sound, and when the vibrations exceed 7520 in a second, the tones cease to be discriminated.

10 beats of a healthy pulse is equal to 9 seconds.

The sun is 7 days 16 hours 51 min. longer in the northern signs than in the southern.

The Mahomedans for 1830 begin June 22; 1831, June 12; 1832, May 31; 1833, May 21; 1834, May 10; 1835, April 29; and going back will be in 1895 on June 22 again; and in another sixty-five years, or 1960, begin the year on June 26th.

The Roman *lustra* were periods of 5 years; and the Greek olympiads periods of 4 years; and the first commenced in 776 B. C. The Metonick cycle was 19 years, intended to be equivalent to the Chaldean period. It was afterwards adopted as the golden number for Easter.

The Hegira, or Flight, took place July 16, 622, and is the Mahomedan Era. Their year is 12 lunar months, or 354 days, 8 hours, 48 minutes; and eleven days being lost, a year must be allowed every thirty-three, to reconcile their dates with ours.

The periodical month of the Turks and Arabs, or sidereal period of the Moon is 27 d. 7 h. 43 m. 48 sec. The synodical month, or return to the conjunction of the Sun is 29 d. 12 h. 44 m. 3 sec. 11 thirds.

The Jews began the year in March, and the months were Nisan, Zif, Sivan, Tammuz, Ab, Elul, Tisri, Bul, Cisleu, Tibeth, Shebat, Adar. The Sabbath, or seventh day is Saturday. The days and nights, from sunrise and sunset, were divided into twelve equal parts or hours, 1, 2, 3, &c. The night watches were three hours each, from sunset to sunrise. The months were lunar, or 30 and 29 days, and they introduced an extra month every two or three years. The day commences and ends at sunset.

The Jewish months were alternately 29 and 30 days, and their year of twelve lunations 354 days. Their year commences with the vernal equinox. To recover the four

days they intercalate a whole month after every two or three years, following their twelfth month, or Adar; and they call this extra month, ve-adar.

The Jewish day commences at six in the evening, or sunset, and continues till the same hour on the following evening.

Their civil year commences with the new moon near the vernal equinox, in the month called Tisri, of 30 days, corresponding with part of September and part of October.

The year 1829 was the Jewish year 5589, and ended Sept. 27, beginning Sept. 9, 1828.

The Mahometan year in 1829 was 1244, and ended July 2, beginning July 14.

The Persians give names to every day in the month, just as we give them to days of the week.

Saturday, the 7th day, is, by the Arabs, called *Sabt*. And Monday is called Jama, in all the eastern languages.

St. David's Day is March 1; St. Patrick's, March 17; St. George's, April 23; and St. Andrew's, Nov. 30; St. Deny's, Oct. 9.

Law proceedings preserve the Roman names of the days, as *Dies Solus*, *Lunæ*, *Martis*, *Mercurii*, *Jovis*, *Veneris*, and *Saturni*, derived from the Roman deities. But in ordinary use, the names are derived from the Saxon or Teutonick deities, the *Sun*, *Moon*, *Tuesco*, *Woden*, *Thor*, *Friga*, and *Saturn*.

The months, or lunar periods, are Roman; and September, October, November, and December, were so called when the Roman year began in March.

April is so called from Aperit, the Spring.

As the orbits of the planets complete their seasons, their periods are taken to be their years; hence Mercury has nearly four years in ours; Venus $\frac{8}{9}$ds; Mars is nearly 4 times as long; Jupiter 12 times; Saturn 30; Herschel 83; and more distant planets longer.

September, &c. were the 7th, &c. month of the year of Romulus.

From the spring to the summer solstice is	92d. 21h. 45′
From the summer to the autumnal equinox	93d. 13h. 35′
Northern signs.	
From the autumnal to the winter solstice	89d. 16h. 47′
From the winter to the spring equinox	89d. 1h. 42
Southern signs.	

GENERAL CHRONOLOGY.

The Dominical Letter is the Sunday letter of the year, A being always taken as January 1; and A, B, C, D, E, F, G, being the Dominicals. The 52 weeks give but 364 days, instead of 365; the Dominical letter, therefore, falls back *one* in every succeeding year, and two when 366 days, or in leap-year.

To find the *Golden Number*, or year of the *Lunar Cycle*, add one to the date and divide by 19, then the quotient is the number of cycles since Christ, and the remainder is the Golden Number.

The Cycle of the Sun is the 28 years before the days of the week return to the same days of the month. It is found by adding 9 to the date of the year, and dividing by 28; the quotient is the number of cycles, and the remainder is the number of the cycle wanted.

The Epact is the moon's age on the 1st of January. A year is 12 moons and 11 days. To determine this from 1800 to 1900, substract 1 from the Golden Number, found as above, multiply by 11, and divide by 30, and the remainder is the moon's age for January 1.

To find the moon's age on any day, add the epact of the year, the epact of the month, and the day of the month together; if less than $29\frac{1}{2}$, it is the moon's age, if more take $29\frac{1}{2}$ from it. The epact of the month —0 for January, 2 for February, 1 for March, and 3, 4, &c. to 10 from April to December.

The time of the moon's southing is four-fifths of an hour later every day from the last new moon.

Easter is the first Sunday after the first full moon that occurs after the 21st of March: to find it add 6 to the

epact, and substract from 50, or if the sum is above 30, substract the remainder, and the difference is the day of the full moon, counting from after March 1; this is called the Easter limit, and Easter Sunday is the following Sunday. To fix the day of the month add 4 to the number of the dominical letter for the year and substract the sum from the Easter limit; then take this remainder from any multiple of 7 *greater* than the said remainder, and add the new remainder to the Easter limit, and the sum will be the day on which Easter Sunday falls in March, if less than 31, or in April if more than 31.

Epiphany, or 12th Day, celebrates the arrival of the wise men of the East.

Plough Monday is the end of Christmas.

The purification, or Candlemas celebrates the Jewish ceremony of the presentation of the Mother of Jesus.

Quadragesima Sunday is the first Sunday in Lent, Septuagesima is the Sunday before, and Quinquagesima precedes.

Ash Wednesday is the day which commences the forty days of Lent, when for four days the Popes sprinkle ashes.

Lady-Day the day of the Virgin's miraculous conception.

Palm Sunday celebrates Christ's entrance into Jerusalem.

Maunday Thursday when kings give alms, &c. to the poor.

Good Friday celebrates the crucifixion.

Easter Sunday celebrates the resurrection.

Ascension-day is forty days after Easter Sunday.

Whit-Sunday is forty-nine days after Easter Sunday, and also the day of Pentecost.

Trinity Sunday is the next after Whit-Sunday.

Lammas was an ancient quarter day, according with Whitsuntide, Martinmas, and Candlemas.

Michaelmas is a festival in honour of Michael and the Angels, recorded in the Revelations, and an angel much spoken of by Magicians.

All Saints is a day of prayer for saints who have no special days.

Advent Sunday is that which is nearest to St. Andrew's day.

Christmas celebrates the birth of Christ.

St. Stephen's and the Holy Innocents celebrate the massacre of the first martyr and the children by Herod.

These and other days, to the number of 300, besides Sundays, used to be celebrated by the Catholic Church, and being identified with the customs of the nation, have been preserved in the Angelical Church, though they are unknown and unnoticed by Dissenters. They fill up a column in the Almanacks, and they are so numerous in Spain, &c. as to render 300 days mass or holidays.

The Christian Æra was first adopted so late as the sixth century in the reign of Justinian; and hence the various difficulties of fixing it with precision: but it is generally considered as commencing in the year 4004 from the creation of Adam.

The *Solar* Cycle is a period of 28, when the days of the week and month again coincide.

The Cycle of *Indiction* was 15, and began 3 B. C.

The three cycles, 19, 28, and 15, multiplied, produce 7980 changes, after which period they return in the same order as before; and this is called the Julian Period. The year 1 of Christ is 4714 of this imaginary period.

The Epact is the eleven days which the solar year exceeds twelve lunations.

Jesus Christ is believed to have been born in the 43d year of Augustus, when Lentulus and Piso were consuls, in the 4th of the 194th Olympiad, and 4004 or 4005 from Adam.

Easter is a festival which the early Christians kept on the same day as the Jewish Passover, and others kept it on the first Sunday after the first full moon in the year; but it is now kept on the Sunday which follows the full moon after the 20th or 21st of March.

Chronologers adopt the following epochs:—

Creation	4004 B.C.
Deluge	2348
Calling of Abraham	1921
Argonautic Expedition	1225
Destruction of Troy	1184
1st Olympiad	776
Building of Rome	753
Nabonassar	747
The Seleucidæ	312
The battle of Actium	38
Dioclesian	284 A.C.

The chief epochs of Jewish chronology, according to received authorities, are as under:—

Creation of Adam	4004 B.C.
Deluge	2348
Death of Abraham	1821
Drowning of Pharaoh	1491
Death of Joshua	1443
Death of David	1015
Division of the kingdom between the ten tribes and two	975
Dispersion of the ten tribes	721
Captivity of the two	606
Return of the two from Babylon	536
Death of Judas Maccabeus	161
United to the Roman Empire	63

The Alphonsine Tables make the creation 6934 B.C.

The period from Adam to the Flood, is by the Hebrew version 1656 years; the Samaritan 1307; the Septuagint 2262; and Josephus 1556.

Chronologists distinguish dates and epochs by letters, as A. M. Anno Mundi; A. C. Anti Christi, or B. C. before Christ; and A. D. Anno Domini; or A. C. after Christ.

A. U. C., *ab urbe conditor*, from the building of Rome, 753 B. C. Greek epochs are marked *Olym.*, meaning the number of the Olympiad, which began 776, in periods of four years, beginning from our July, or their Hecatombeon. Hence the year 0 of Christ answers to the 4th year of the 194th Olympiad.

The Greek Church date the Creation 5508 years B. C., and begin the year in March.

The early fathers placed the year of Creation 5502 B C, and added the year A. D. to it. Others made it 5492, and the latter, 16 years less than the Greek Church, is still used by some Eastern Churches.

The modern Jews date the Creation 3760¼ B. C., and the year A. D. added gives the Jewish year; thus, 1830 A. D. is 5590 Jewish.

The Julian period is merely the arithmetical product of three cycles. It is in chronology like a balance wheel in mechanics. The multiplier is 7980, and our era begins in its 4713th year.

The early Christians, till the era of the birth of Christ was estimated, dated from the accession of Dioclesian in 284, called the era of Martyrs. The Coptic Christians still adopt it, beginning the year on the day of Dioclesian, Aug. 29, or in the month Thoth.

The era of the Seleucidæ, 311 B.C., of Alexander 323 B. C., and of the Battle of Actium 31 B. C., of the Cæsars 38 B. C., of Tyre 125, of Abraham 2016, and of Antioch 49, were also used by some early writers.

The Hindoo era of the Caliyug began 3101 B. C. or 750 years before the Deluge in 2348, and they count their months by the progress of the sun through the zodiac. The Samoat begins 57 B. C., and the Saca 77 A. C. All used.

The cycle of Jupiter is 60 years, or Sexagenary, and they are now in the 35th year of the 84th cycle, every year having a proper name.

The Chinese adopt also the Sexagenary cycle of 60 years, giving a name to each year. Seventy-five cycles have elapsed, and they are now in the 76th, the era commencing in 2700 B. C. or 350 before the Deluge. It was established by the Emperor *Hevang-te*, and is also adopted by the Japanese.

The Mexican era began in 1090, A. C., and their year was correctly astronomical.

The epoch of the Mosaic creation is fixed by the Samaritan Pentateuch at 4700 years B. C. The Septuagint makes it 5872. The authors of the Talmud make it 5344; and different chronologers, to the number of one hundred and twenty, make it vary from the Septuagint date to 3268. Dr. Hales fixes it at 5411; but the Catholic church adopt-

ed the even number 4000, and subsequently, a correction as to the birth of Christ adds four years · therefore, it is now generally considered as 4004 years, which agrees with the modern Hebrew text. The modern Jews call this the year 5590, which carries the commencement to the year 3761, B. C.

The year 1830 corresponds to the year 6543 of the Julian period.

Since the first Olympiad 2606;

Since the foundation of Rome 2583;

Since the era of Nabonassar 2578.

The following are the most memorable events in Jewish and other histories, reckoned backward from the birth of Christ:

The Deluge	2348
Babylon built	2247
Kingdom of Egypt founded	2188
Birth of Abraham	1993
Semiramis flourished	1990
Argos founded	1856
Sesostris flourished	1722
Death of Joseph	1635
Moses born	1571
Athens founded	1556
Cadmus founded Thebes	1493
Moses died	1451
Tyre and Sidon rivals	1448
The first Olympic games	1443
The Argonautic Expedition	1263
The Pyramids built	1250
Troy taken	1209
Codrus, King of Athens	1069
David, King of Israel	1053
Solomon's Temple finished	1004
Homer and Hesiod flourished	907
Death of Lycurgus	873
The first Olympiad	776
Rome founded	753
Samaria taken	721
The Pentateuch founded by Hilkiah	625
Nebuchadnezzar flourished	600
Solon and Thales flourished	594
Jerusalem taken and destroyed	587
Cyrus became king of Persia	559
Babylon taken by Cyrus	538
The Tarquins expelled	509
The battle of Marathon	490
Aristides banished	484
The sea-fight at Salamis	480
Herodotus flourished	445
Phidias flourished	440
The Peloponnesian war	431
Death of Pericles and Anaxagoras	428
Death of Socrates	400
Rome taken by the Gauls	385
The Death of Plato	348
Alexander destroyed Thebes	335
Alexander built Alexandria	332
Alexander died at Babylon	324
Aristotle and Demosthenes died	322
Praxiteles died	288
The Alexandrian Library founded	283
The Death of Epicurus	270
The first Punic war	264
End of the first Punic war	242
Romans conquered all Italy	226
The Battle of Cannæ	216
The Death of Archimedes	212
Jerusalem taken by Antiochus	170
Persius defeated	167
Judas Maccabeus flourished	166
The last Punic war	149
Carthage destroyed	146
Death of Tiberius Gracchus	133
Athens taken by Sylla	86
Sylla perpetual Dictator	82
Syria conquered by Pompey	64
Cæsar landed in Britain	55
Gaul conquered	51
Cæsar made Dictator	49
Pompey killed	47
Cæsar killed	44
Cicero killed	43
Battle of Actium	31
Death of Horace	8
Birth of Christ	0

I have taken the year of the Flood after Usher and Blair, but the Septuagint makes it 3426; Josephus 3146; the Samaritan 2998; and the modern Jews 2104. Herodotus and the Greeks notice none of these Jewish periods, but they mention a deluge in Attica in the reign of Ogyges, in 1764, 500 years after the other; and various notices are taken of a deluge 250 years afterwards in Thessaly, when Deucalion fled to Athens.

There is also some uncertainty about the epoch of the birth of Christ, and whether he was crucified in the 15th, 16th, or 19th year of Tiberius. The early fathers assigned but one year to the period of his public preaching, others two, and Eusebius made it three and a half; and if so, that he lived till the 19th of Tiberius. The chronology was not inquired into till long after the events; and the Christian festivals appear to have been fixed astrologically. The feast of the Virgin Mary being fixed on the day the sun enters Aries; that of John the Baptist

on entering Cancer; that of Michael on entering Libra; and that of Jesus on entering Capricorn, being the four cardinal points. So they fixed the other saints' days on the day the sun entered the other signs; St. Paul on entering Aquarius; Matthew on entering Pisces; Mark on entering Taurus; Corpus Christi on entering Genini; St. James on entering Leo; St. Bartholomew on entering Virgo; Simon and Jude on entering Scorpio. This, at least, is the opinion of Hewlett and others, and the days correspond, allowing for the precession of the equinoxes.

Death of Augustus A. C. 14
Death of Ovid and Livy 17
Pilot, Governour of Judea 27
Sejanus put to death 31
Jesus Christ crucified 33
Death of Tiberius 37
Claudius succeeded Caligula 41
Claudius visited Britain 43
Nero succeeded Claudius 54
Boadicca defeated 61
Seneca and Lucan put to death 65
St. Peter and St. Paul put to death 67
Galba succeeded Nero 68
Otho succeeded Galba, and Vitellius Otho 69
Jerusalem taken and destroyed 70
Titus succeeded Vespasian 79
Pliny killed at Vesuvius 79
Domitian succeeded Titus 81
The Dacian war began 88
Death of Josephus 93
Nerva succeeded Domitian 96
Trajan succeeded Nerva 98
Death of Tacitus 99
St. Ignatius destroyed at Rome 108
The first Bishop of Rome 109
Trajan subdued Assyria 115
Jerusalem rebuilt, and the Temple dedicated to Jupiter 130
The Romans destroyed 580,000 Jews, and banished the rest from Judea 135
The Romans agreed to pay tribute to the Goths 222
The Temple of Diana at Ephesus destroyed 260
The Goths and Heruli defeated by Claudius II., and 300,000 killed 269
The 9th persecution of the Christians 272
Palmyra taken 273
Dioclesian divided the empire 292
Constantine tolerated the Christians 323
The Council of Nice 325
Constantinople made the capital of the Empire 329
The Mythological Temples demolished 331
Death of Constantine 337
Death of Eusebius 342
The Emperor Julian abjures Christianity 361
Theodosius Emperor of the East 379
His Death 395
Europe overrun by Alaric 401
Rome sacked by Alaric 410
The Romans left Britain 426
Genseric the Vandal overran Italy, and invaded Africa 439
Pope Leo the Great 440
Attila and the Huns overran Europe 447
The Saxons arrived in Britain 451
Rome taken by Genseric 455
Hengist murdered 300 British nobles 475
Rome taken by Odoacer, and he made King of Italy, which put an end to the Roman Empire 1229 years after the building of Rome 476
Clovis King of the Franks 481
Death of St. Patrick 491
The Bishop of Rome asserted his supremacy 494
Alaric defeated and killed by Clovis 507
Arthur King of Britain 515
The Christian era invented and introduced by Dionysius, a monk 516
Justinian made Emperor of the East 527
Totila the Goth took and plundered Rome 547
Retaken by Belisarius 549
And recovered by Totila 550
The Heptarchy begun in England 555
Death of Justinian and Belisarius 569
The Latin tongue ceased to be spoken 580
The flight of Mahomet from Mecca to Medina 622
Death of Mahomet 633
Jerusalem taken by Omar 636
The Saracens conquered Northern Africa 698
Spain conquered by the Saracens 713
The Christian religion propagated in Germany 719
Charles Martel defeated the Saracens 732

The Christian era first used in books 748
Bagdad built by Almanzor 762
Charlemagne king of France 772
——— subdued the Saxons 781
The Huns extirpated by Charlemagne 794
Charlemagne crowned at Rome 800
The Normans arrived in France 808
Death of Charlemagne 814
The Heptarchy united by Egbert 827
Rome besieged by the Saracens 846
Christianity preached in Denmark and Sweden 850
The Danes ravaged England 867
Alfred defeated the Danes 878
Death of Alfred 901
Rollo flourished in Normandy 912
Sueno King of Denmark 980
Sueno conquered England 1013
Canute King of England 1017
Macbeth murdered Duncan 1040
The Turks took Bagdad, and overturned the empire of the Caliphs 1055
The battle of Hastings, and Norman conquest 1066
Feudal law introduced 1070
Doomsday book finished 1086
First Crusade 1095
Jerusalem taken by the Crusaders 1099
William Rufus killed in the New Forest 1100
Death of Abelard 1143
The second Crusade 1147
The Bank of Venice established 1157
Becket killed at Canterbury 1171
Ireland conquered 1172
Jerusalem taken by Saladin 1187
Saladin defeated by Richard I. 1192
The fourth Crusade 1202
The Inquisition established 1204
King John excommunicated 1208
Magna Charta signed 1215
Russia conquered by the Tartars 1238
The fifth Crusade 1248
Wales conquered 1254
Bagdad taken by the Tartars, and the Saracen Empire terminated 1258
The first English House of Commons 1258
Massacre of the French in Sicily 1282
Wales united to England 1283
Death of Friar Bacon 1284
The Jews banished from England 1290
Death of Cimabue, the reviver of painting 1300
The King of France excommunicated 1301
The Popes removed to Avignon 1308
Battle of Bannockburn 1314
Battle of Cressy 1346
Battle of Poictiers 1356
The Popes returned to Rome 1377
A second Pope chosen at Avignon 1378
Death of Wicliffe 1385
France under a Papal interdict 1407
The Council of Constance deposed two Popes 1414
John Huss burnt 1415
Jerome of Prague, do. 1416
Joan of Arc defeated the English at Orleans 1428
Constantinople taken by the Turks 1453
Battle of Towton 1462
Battle of Barnet 1471
Battle of Tewkesbury 1471
Castile and Arragon united 1479
Battle of Bosworth 1485
The Moors expelled Spain 1491
Savanarola burnt at Rome 1498
Battle of Flodden 1513
Luther began to preach 1517
Mexico invaded and plundered 1521
Battle of Pavia 1525
Rome taken by the Germans 1527
Servetus burnt by the reformer Calvin 1531
The Pope's authority in England abolished 1533
645 monasteries and religious houses suppressed in England 1539
The Council of Trent from 1545 to 1563
Cardinal Beaton put to death 1546
Interest fixed at ten per cent. in England 1547
Eldest sons of Peers permitted to sit in the House of Commons 1550
Five Bishops burnt by Philip and Mary 1555
Charles the Vth resigns his Government 1557
Death of Calvin 1564
Rizzio murdered 1566
Murray murdered 1569
Massacre of St. Bartholomew 1572
Death of Knox 1572
Republick of Holland commenced 1579
Mary Queen of Scots put to death 1587
The Spanish Armada defeated 1588
The first newspaper in England 1588
Bank of England incorporated 1594
Edict of Nantes tolerating Protestants in France 1598

East-India Company established 1600
Union of England and Scotland 1603
Gunpowder Plot 1605
Spain acknowledged the indepence of Holland 1609
Henry IV. of France assassinated 1610
Shakspeare died 1616
Vanini burnt at Toulouse 1619
Death of Cervantes 1620
Huguenot, or religious war in France begun 1621
Death of Lord Bacon 1626
Buckingham assassinated 1628
Nine members of the House of Commons imprisoned 1629
Bagdad taken by the Turks 1631
Battle of Lutzen 1632
Hampden's trial in the exchequer 1637
Lord Strafford beheaded 1641
Massacre in Ireland 1641
Battle of Edgehill 1642
Death of Galileo 1643
Archbishop Laud beheaded 1644
Death of Hampden 1644
The Tartars overrun China 1644
Battle of Marston Moor 1644
Battle of Naseby 1645
Charles I. delivered up by the Scots 1647
Peace of Westphalia 1648
Charles I. beheaded 1649
Battle of Dunbar 1650
Death of Des Cartes 1651
Battle of Worcester 1651
War of England and Holland 1652
The English fleet defeated 1653
Cromwell dissolved the Long Parliament, and made Protector 1653
Death of Gassendi 1656
Death of Harvey 1657
Death of Cromwell 1658
Charles II. restored 1660
Prussia independent 1663
Great plague in England 1665
Great fire of London 1666
Candia taken by the Turks 1669
Murder of the De Witts 1672
Death of Milton 1674
The Habeas Corpus Act passed 1678
Lord Russel and Algernon Sydney put to death 1683
Death of Colbert 1684
The edict of Nantes revoked 1685
Battle of Sedgmoor 1686
Seven Bishops sent to the Tower 1686
Revolution in England 1688
Battle of the Boyne 1690
The French Fleet defeated the English and Dutch 1691
Surrender of Limerick 1691
Battle of La Hogue 1692
Hanover made an Electorate 1692
The English funding system commenced 1694
Treaty of Ryswick 1697
Battle of Narva 1700
Death of James II. 1701
Gibraltar taken 1703
Battle of Blenheim 1704
Barcelona taken 1705
Battle of Ramilies 1706
Battle of Almanza 1707
Battle of Oudenarde 1708
Battle of Pultowa 1709
Battle of Malplaquet 1710
Treaty of Utrecht 1713
The interest of money in England fixed at five per cent. 1714
Louis XIV. died 1715
Death of Leibnitz 1716
Charles XII. killed 1718
The Mississippi bubble 1719
The South Sea bubble 1720
Death of Peter the Great 1725
Death of Newton 1727
Koulin Khan made king of Persia 1733
—— conquered the Mogul Empire 1739
Porto Bello taken 1740
Battle of Dettingen 1743
Anson's voyage completed 1744
Battle of Fontenoy 1745
Battle of Culloden 1746
Kouli Khan murdered 1747
Lord Lovat, &c. beheaded 1747
Peace of Aix-la-Chapelle 1748
Braddock defeated 1755
Battle of Colin 1757
Battle of Hockkerken 1758
Louisburgh taken 1759
Battle of Minden 1759
Quebec taken 1759
Havana taken 1762
Treaty of Fontainebleau 1763
Wilkes' first election for Middlesex 1769
Do. second and third 1769
The Shakspeare jubilee 1769
Peace with Hyder Ally 1770
Partition of Poland 1772
Commencement of the American War 1775
Declaration of American Independence 1776
Meeting of Deputies at London for Parlimentary Reform 1780
Recognition of American Independence 1782

Call of the States-general in France 1788
Taking of the Bastile 1789
French Republick proclaimed 1792
Louis XVI. guillotined 1793
French declaration of war against England and Holland 1793
Robespierre guillotined 1794
The Bank of England suspended its payments in cash 1797
Bonaparte made Consul 1799
Battle of Marengo 1800
Peace of Amiens 1802
War renewed between England and France 1803
Bonaparte crowned Emperour 1804
Battle of Austerlitz 1805
Battle of Trafalgar 1805
Battle of Jena 1806
Battle of Friedland 1807
Peace of Tilsit 1807
Napoleon seized Ferdinand at Bayonne 1808
Battle of Wagram 1809
Marriage of Napoleon with the Arch-Duchess Maria Louisa 1810
Moscow burnt, and the French armies destroyed by frost 1812
Battle of Vittoria 1813
Battle of Leipsic 1813
Paris surrendered to the Allies 1814
Treaty of Fontainebleau 1814
Treaty of Vienna 1814
Napoleon returned from Elba 1815
Battle of Waterloo (June 18) 1815
Napoleon surrenders to the Bellerophon 1815
Treaty of Ghent, between England and America 1819
Tragical assault of petitioners at Manchester 1819
The Republick of Columbia proclaimed 1819
Do. Peru, Chili, and Mexico 1820
Death of Napoleon 1820
Death of George III. 1820
Trial of Queen Caroline 1821
War of Russia and Turkey 1829
Catholick disabilities in England removed 1829

DISCOVERIES.

1345 The Canarics.
1418 Madeira.
1432 The Azores.
1486 Cape of Good Hope.
1492 America.
1673 Louisiana, by the French.
1686 Easter Island, by Roggewein.
1690 Kamtschatka, by the Russians.
1770 New South Wales, discovered by Cook.
1771 Sandwich Islands, by do.
1774 New Caledonia, by do.
1819 New South Shetland, by Williams.

The Icelanders discovered the Continent of America about 1000, and called it Winenland, from the vines in which it abounded.

The South Sea was first seen by Europeans in 1513 from Mexico.

Japan was discovered in 1542.

Cape Horn was discovered by Le Maire and Schouton in 1616.

The discoveries on the North-west Coast have extended from East to West to 149½ West, and from West to East to 156½, leaving 7 degrees in lat. 74 unexplored, or 140 miles. In Parry's Voyage to Melville's Island, the thermometer was 55° below Zero in lat 74¼.

DATES connected with the progress of knowledge and improvements since the Christian era.

274 Silk brought from India.
373 the Bible in Gothic.
400 Bells mounted.
493 Silk-worms in Europe.
660 Organs used.
663 Glass in England.
800 The Aristotelian Philosophy introduced.
830 Oxford University.
991 The Arithmetical Digets.
1080 Doomsday Book.
1124 Musical notes.
1200 Mariner's Compass.
1220 Astronomy cultivated in England.
1239 Coals dug as fuel.
1299 Spectacles invented.
1302 Cambridge University.
1319 Dublin University.
1341 Petrarch crowned at Rome.
1360 Wickliffe flourished.
1436 Printing invented.
1454 University of Glasgow founded.
1464 Posts and Diligences established.
1470 The first Almanack.
1471 Printing in England.
1517 Luther began to publish.
1543 Copernican System published.
1549 Telescopes invented.
1602 Decimal Arithmetick.
1604 Satellites of Jupiter.
1614 Logarithms invented.
1619 Circulation of the Blood.
1623 Barometer invented.
1662 Royal Society established.

1682 Philadelphia founded.
1680 Air-pump discovered.
1710 Newcomen's Steam-Engine.
1716 Death of Leibnitz.
1720 Inoculation introduced.
1722 Electricity improved.
1726 Petersburgh Academy established.
1730 Farenheit's Thermometer.
1736 Gottingen University established.
1753 British Museum established.
1768 Steam Engines improved.
1771 Cook's First Voyage.
1773 Cotton Spinning Machinery.
1778 Linnæus died.
1784 Euler died.
1788 Galvanism discovered.
1797 Priestley died.
1798 Vaccination announced.
1781 The Planet Herschel discovered.

The Hindus have no civil chronology, but their epochs are astronomical and theological. They record fifty-five sovereigns of the sun before the Christian era, which Sir W. Jones extends through a period of 1600 or 2000 years. But the priests make nine incarnations of Vishnu at very distant periods of time; and the astronomers have observations several thousand years old, displaying a perfection of science, of instruments, and various knowledge, which indicates ages of preparation. Their astronomical cycles are, of course, mere abstract calculations, and their reference to a standard position in Aries fanciful; while the discovery of Herschel, four small planets, and seventeen moons, render their vast calpa futile.

The *beginning* of Moses is a sublime indefinite, and all the stages of the earth, from the granitick formation, the transition rocks, and all the secondary strata, may have occupied millions of years in progressing to their present state from the beginning of Moses. Observations of 500 or 1000 years would enable the Hindus to arrive at the mean periods on which their celestial chronology is founded.

The 50 past calpas, 6 manwanteras, 27 yugs, and the satya of the 28th, with the sandya at the beginning of the calpa, make a total of past time of 1970784000 years, in which Brahmin was 17064000 years in creating, after which the planetary motions commenced. A point gravely asserted.

The maya-yug of 4320000 years is divided into the satya yug of .4, the treta of .3, the dwaper of .2, and the cali-yug of .1

At the close of each manwantera, of 71 maha-yugs, there is, say they, a period equal to a satya-yug of universal deluge, of 1728000 saura-years. This, in principle, accords with my own theory, but the time is fanciful; though one sect of Brahmins assert a period of deluge equal to mine, and at the same intervals.

There are 57753.336 lunations in a maha-yug, and 1577917828 days from sunrise to sunrise; which gives 29 d. 12 h. 44′ 2″ 47‴ 36⁗ for a mean lunation, and 365 d. 15 h. 31′ 31″ 24‴ for the length of a year, and all other periods are equally minute. The moon's apogee and nodes have increased four revolutions in a yug since these tables were formed. The obliquity was then taken at 24°.

MATHEMATICKS AND PHYSICKS.

Signs express the relations of quantities: they are of different kinds, as, The sign of *addition*, +, called plus, as $a+b$, reads a plus b. The sign of *substraction*, —, called minus, as $a-b$, reads a minus b, or b substracted from a. The sign of *multiplication*, ×, as $a \times b$, signifies that a is multiplied by b. Multiplication is also expressed by a full-point (.), and by *into*, as $\overline{a+b} \,.\, \overline{c+d}$, or $\overline{a+b}$ into $\overline{c+d}$. The sign of *division*, ÷, as $a \div b$ signifies that a is divided by b; or in the form of a fraction, as $\frac{a}{b}$. ∷∷ are the signs of *proportion*, as $a : b :: c : d$, signifies that a is to b as c is to d. The *radical* sign $\surd$, denotes the root of the quantity as $\surd a$ is the square root of a, or the cube, biquadrate, &c. as $\sqrt[3]{a}$, $\sqrt[4]{a}$, &c.: or by fractions, as $a^{\frac{1}{2}}$, $a^{\frac{1}{3}}$, $a^{\frac{1}{4}}$, $a^{\frac{1}{n}}$, for the square, cube, biquadrate, and nth or indeterminate root of a.

$a-1$, $a-2$, $a-3$, &c. denote inverse powers of a, and are equal to $\frac{1}{a^1}$, $\frac{1}{a^2}$, $\frac{1}{a^3}$, &c.

The sign of *equality*, = as $a + b = x$, or a added to b is equal to x.—— The sign of *difference*, ∞, as $a \infty x$, signifies either $a - x$ or $x - a$.

7 is put between two quantities to express that the former is greater than the latter, as $a \ 7 \ b$, as a more than b; $\angle$ signifies the reverse, as $a \angle b$, as a less than b.

A *Vinculum* is a line drawn over several quantities signifying that they are to be taken collectively, as $\overline{a - b + c} \times \overline{d - e}$ signifies that the quantity represented by $a - b + c$ is to be multiplied by $d - e$; so of the powers and the roots of quantities; thus, $\overline{a + b}|^2$ denotes the square of $a + b$ as one quantity, and $\overline{a + b}|$ the cube; ∴ or ∵ signifies *ergo*, or therefore.

In calculations lines or single dimensions can only be compared with lines; superfices or double dimensions with superfices; and cubes or treble dimensions with cubes. Quantity of matter in cubes is detected only by relative momenta as in the varied momenta of weight, the varied reaction of resistance, in the same medium, &c. There is no ratio between finites and infinites, all finites having the same indeterminate ratio to the mere creation of the mind called infinity; therefore all knowledge is strictly limited to the ratios of finites. All momentum is quantity of matter multiplied into velocity; and momentum or power is evidence of matter and velocity acting in the direction of the resulting momentum.

Fluxions were an invention of Newton, and at the same time and independently Leibnitz invented the differential calculus. It is thus in almost all new inventions knowledge advances to a certain point and then several make the next step at the same time. Newton's invention is however laid aside, and the differential calculus preferred by all modern mathematicians.

Duple ratio is that of 2 to 1. *Sub-duple* that of 1 to 2. And *duplicate* ratio is that of the square of one number to the square of another. *Sub-duplicate* is the ratio of the square roots.

If the square of the diameter of a circle be multiplied by .7854 the product is the area. If the diameter of a sphere be cubed and multiplied by .5236 the product is the solidity; and the square of the diameter multiplied by 3.14159 is the surface of a sphere.

The branch of mathematics called Conick sections arises from the varied curves which a cone produces when cut in different directions; cut obliquely it is an *ellipse;* cut parallel to one side it is a *parabola;* and and when not parallel, but from the side through the base, is called an *hyperbola*. The ancient mathematicians exhausted the investigation of these figures, and the moderns have been equally industrious. The longer axis of an ellipse is called the transverse axis; the distance of either focus from the centre of the transverse axis is called the eccentricity; the axis drawn through the centre at right angles to the other, is called the *conjugate* axis; any straight line passing through the centre is a *diameter*, and any chord to a *diameter* divided equally by it, is called an *ordinate;* the unequal parts of the diameter are called *abcissæ*. A third proportional to a diameter and its conjugate is the *parameter* and *latus rectum*. Conjugate diameters are parallel to each other's tangents. A line which joins either focus to the circumference is called the *radius vector*.

In the *parabola*, the abscissa is a third proportional to the parameter and semi-ordinate. In the *ellipsis*, the square of the semi-ordinate is equal to the rectangle of the parameter and abscissa, less a rectangle of the same abscissa, and a fourth proportional to the axis, parameter, and abscissa. In the *hyperbola* the squares of the semi-ordinates are to each other, as the rectangles of the abscissa and a line formed of the abscissa and transverse axis.

The radius of a circle is equal to an arc of 57.2957795 degrees.

The word digit, applied to the 10 figures, comes from digitus, a finger; computation being, in ancient times, performed by the 10 fingers.

To find the surface of a spherical zone multiply the product of the diameter, into the height by 3.14159. To find the solidity add the squares of half the two diameters to $\frac{1}{3}$d of the square of the height; multiply

this sum by the height and product by 1.5708.

The surface of the segment of a sphere may be found by multiplying the diameter by the height, and this by 3.14159; and the solidity by multiplying the height by .5236; and the product by three times the diameter less twice the height; or to three times the square of half the diameter of the base add the square of the height, multiply the product by the height and this product by .5236.

To find the contents of a cask, add double the square of the bung diameter to the square of the head diameter, and multiply this sum by the length of the cask, then divide the product by 1077 for ale gallons of 282 cubick inches each, or by 882 for wine gallons of 231 cubick inches each.

Laguy carried the ratio of the diameter to the circle to 128 figures, 20 of which are as follows, 31,41592653 5897932384, &c.

Prime numbers are those which have no divisor; perfect numbers are those which are equal to the sum of all their divisors.

The prime or indivisible numbers under 100 are, 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89 and 97.

Pyramids are one-third of prisms of equal base and height. They are to each other as their bases and heights. One third of the area of the base by the height is the solidity. The surface is half the product of the length of the base by one of the sides.

The area of a trigon when each side is 1, is 0.433.

of a Pentagon · · · · · 1.72
of a Hexagon · · · · · 2.598
of a Heptagon · · · 3.6339
of an Octagon · · · 4.8284
of a Decagon · · · · 7.6942
of a Dodecagon · · 11.196

Square the side and multiply by these numbers.

To find the fall of a body in a second, multiply the square of 3.1416 by the length of the seconds pendulum, and divide by 2.

The dip of the horizon for various heights of the eye is as under, to be deducted.

6 feet · · · ·	2′ 20″
10 feet · · · ·	3′ 1″
20 feet · · · ·	1′ 16″
30 feet · · · ·	5′ 14″
40 feet · · · ·	6′ 2″
50 feet · · · ·	7′ 23″
100 feet · · · ·	9′ 33″

The refraction of the air for different altitudes is as under, to be deducted.

Horizontal 33′

1°	24′	29″	20°	2′	35″
2	·· 13	35	30	·· 1	38
3	·· 14	36	40	·· 1	8
4	·· 11	51	50	·· 0	48
5	·· 9	54	60	·· 0	33
10	·· 5	15	75	·· 0	15
15	·· 3	30	85	·· 0	5

The arithmetical mean is half the sum, and the geometrical mean is the square root of the product.

Quincunx is 1 at each of 4 corners, and 1 in the middle.

The time of falling through the chord of a circle is equal to the time of descent through the diameter; and through all arcs of a cycloid are equal.

The proportion of the area of a circle to its circumscribed square, is as 11 to 14.

$8\frac{10}{11}$ is the side of square equal to a circle whose diameter is 10.

Binary logarithms were invented by Euler to facilitate musical investigations, and 2 is their integer instead of 10 in common, and 1 in hyperbolick logarithms.

In inverse proportion more requires less and less more. It is expressed fractionally as $\frac{1}{a}$; a being in inverse proportion.

On an inclined plane, the power gained is as the length of the plane to the length of the base. The velocity in descending to that falling perpendicularly is as the height to the length, and the force is the same. For a body acquires the same velocity as in falling perpendicularly through the height of the plane; and a body acquires the same velocity, in falling down any number of planes, or down a curve as perpendicularly from the extreme height.

The convexity of the earth interposes to prevent the sight of distant bodies: thus at 600 yards 1 inch would be concealed, or an object an

inch high could not be seen in a straight line; at 900 yards, 2 inches; at 1400 yards, 5 inches; at 1 mile, 8 inches; 3 miles, 6 feet; so that at that distance a man would be invisible; 4 miles, 10 feet; 5 miles, 16 feet; 6 miles, 24 feet; 10 miles, 66 feet; 12=95, 13=112, and 14 miles, 130 feet.

In all horizontal distances, $\frac{1}{13}$th. should be added to the distance for horizontal refraction, and Legendre says, $\frac{1}{14}$th. Making this allowance, and remembering that a mile curvates 8 inches, we may determine a distance by knowing the elevation, or an elevation by knowing the distance. By multiplying 8 inches by the square of the distance; thus, if it is 10 miles, 10 times 10 is 100, and 100 times 8 inches is 66 feet as stated; and if the top of a mountain is seen at 50 miles distant, it would be 2500 times 8 inches, equal to 1666 feet of elevation, to which adding $\frac{1}{14}$th for refraction it would make the hill about 1800 feet high, therefore 50 miles would be the extent of the prospect from the top.

The first writer who used algebraick signs, was Stifelius, of Nuremberg, in 1544.

The science of probabilities has been extended in modern times by Laplace and other mathematicians, so as to be applicable to questions of all kinds, but it has for many years been applied to calculations of life annuities, and to chances of dice and cards.

It is a general rule that every probability may be expressed by a fraction, the numerator of which should be the number of chances for happening, and the denominator the sum of the number of chances by which it may happen and may fail. But the probability of its not happening is to be expressed by a numerator of the chances of failing, and a denominator consisting of the chances of failing and happening. The two fractions are of course always equal to one. The value of a chance is found by multiplying the fraction, expressing the probability by the stake. The probability of throwing a particular number with one die is therefore 1 for the numerator, 1 and 5 for the denominator or $\frac{1}{5}$th. Then the probability of throwing the same twice is $\frac{1}{6}$th of $\frac{1}{6}$th, or $\frac{1}{36}$th, or 3 times $\frac{1}{6}$th of 36, or $\frac{1}{216}$th.

If A and B game, and A wins in p cases, and B in q cases, and the stake be a. A's chance is $\frac{pa}{p+q}$ and B's chance $\frac{qa}{p+q}$ universally.

The probabilities of throwing required totals with two dice depends on the number of ways in which the totals can be made up by the dice. 2, 3, 11, or 12 can only be made up one way each, and therefore the chance is but $\frac{1}{36}$th. 4, 5, 9, 10 may be made up two ways, or $\frac{1}{18}$th. 6, 7, 8, three ways, or $\frac{1}{12}$th the chance of doublets is $\frac{1}{36}$th, the chance of particular doublets is $\frac{1}{216}$th.

The number of changes which any number of things, as bells, letters, cards, &c. can produce, is the product of all the figures multiplied together, thus: 1, 2, 3, 4, 5, 6, bells, produce 720 changes.

The chances against holding 7 trumps is 160 to 1; against 6, it is 26 to 1; against 5, 6 to 1; and against 4 nearly 2 to 1. It is 8 to 1, against holding any two particular cards.

The 26 letters of the alphabet make 403 quintillians of combinations; 20, make $2\frac{1}{2}$ quadrillions; and 12 would make 479 millions.

The chance is equal in dealing cards that every hand will have seven trumps in two deals, or seven trumps between two parties, and also 4 court cards in every deal. This is so certain on an average of hands, that nothing can be more superstitious and absurd, than the prevailing notions about luck or ill-luck. The chance of having a particular card out of 13, is $\frac{1}{5}\frac{3}{2}$ds, or 1 to 4, and the chance of holding any two cards is $\frac{1}{4}$th of $\frac{1}{4}$th, or $\frac{1}{16}$th. The chances of a game are generally inversely as the number got by each, or as the number to be got to complete the games.

There are 36 chances upon two dice. It is an even chance that you throw 8. It is 35 to 1 against throwing any particular doublets, and 6 to 1 against throwing any doublets. It

is 17 to 1 against throwing any 2 desired numbers. It is 4 to 9 against throwing a single number with either of the dice, so as to hit a blot or enter. Against hitting with the amount of 2 dice the chances against 7, 8 and 9, are 5 to 1; against 10, is 11 to 1; against 11, 17 to 1; and against sixes is 35 to 1.

The oldest work on algebra is that of Diophantus, who flourished at Alexandria in the 4th century. Its improvers were Vieta, Descartes, Newton, Euler, and La Grange.

The mechanical powers may be reduced to three, but they are usually expressed as six, the lever, the wheel and axle, the pulley, the inclined plane, the screw, and the wedge.

In a single moveable pulley the power gained is doubled. In a continued combination the power is twice the number of pullies, less 1.

In levers, the power is reciprocally as the lengths on each side the fulcrum or centre of motion.

The power gained in the wheel and axle is as the radius of the wheel to that of the axle.

The power gained by an inclined plane is as the length to the height.

The power of a wedge is generally as the length to the thickness at the back.

The power of the screw is as the circumference to the distance of the thread, or as 6.2832 to that distance.

Resistance is an affair of experiment, sometimes a third, and at other times less.

The momentum or force of a body is its matter multiplied by its velocity, and this is the basis of all mechanics and all philosophy. Velocity is as the space passed through in the same time, therefore matter and space are the source of all material power; and wherever power is present there is some matter in some motion.

The contrivances for conveying the power of a machine to the work are

Wheels and pinions on axles.
Conical wheels.
Rack work.
Belts, bands, and chains.
Cranks, single and double.
The universal joint.
The sun and planet wheel.
The ball and socket.

The lever of Lagoaroust, for producing a rectilineal from an alternating circular motion.

Reversing a motion is produced by merely crossing a belt, or making one wheel work into another.

Fly-wheels keep up a constant equal force, from which partial forces are derived, or unequal actions kept uniform.

The friction on under shot water wheels, is $\frac{3}{4}$ths the actual force of the water, which, in falling 15 inches, acquires a velocity of 9 feet nearly in a minute, and then if 265lbs. of head water fall 15 inches, the whole is 3975 for the force, but by experiment it raises but 9375 lbs. 135 inches, or 1266, or $\frac{1}{4}$th nearly. Then 1266 $\times$ by the velocity of the wheel is the whole force, according to Smeaton, independent of reactions of floats, &c. which gives 10 to 3, or 2-8 as the proportion of force and effect. In over shot wheels the power is greater.

An under shot wheel has the greatest force when its circumference moves with $\frac{5}{6}$ths of the velocity of the stream, and the best velocity of an over shot wheel is 3 feet in a second, and depends on proportioning the buckets, the power of the water being as the heighth it falls through. In the under shot wheel the power is to the effect as 3 to 1, and in the over shot wheel double, or 3 to 2.

As every human being had two parents, these four, and these eight, in three generations, ancestors thus double in every generation of $33\frac{1}{3}$ years, and eight-fold in every 100 years; so going back another 100 years, or to 1630, the ancestry of every living person would be 8 $\times$ 8, or 64: in 1530, it would be 8 $\times$ 64, or 512: in 1406, be 4096: in 1330, 32768: in 1230, 221344: in 1130, 2097152; and at the era of the conquest, the ancestry of every one of the English family was the whole population of England; while on the other hand, every one having children at that time was the direct progenitor of the whole of the living race. The race of the year 2530 will in like manner descend from 8 or 9

millions of the present race. In this way the average powers of humanity and of animals are kept up, and without mixture families deteriorate in faculties and become extinct. In one nation the people are all kindred in remote degrees, and had common ancestry.

On examining Zerah Colburn, the calculating boy, who in a minute or two could give the exact product of five or six figures by five or six, or extract the square or cube root of eight or ten figures, the following rules about the square root were elicited:—1. A square number cannot have an odd number of cyphers. 2. If the last figure is a 4, the last but one will be even. 3. If the last is a 5, the last but one is a two. 4. If the last is odd, the last but one is even. 5. If the last is even, except 4, the last but one is odd. The two last cannot be even, except two cyphers or two fours. More than the three last cannot be the same, unless cyphers or fours. George Bidder, another calculating boy, had invented similar sets of rules.

The log-line is divided into spaces of fifty feet, and the way measured by a half minute sand glass, which bears nearly the same proportion to an hour that fifty feet bears to a mile.

The friction of cylinders or wheels is as the pressure, and inversely as the diameter.—*Coulomb.*

Friction, in general, in machinery, is taken at a loss of one-fourth of the power exerted. It arises from the lateral transfer of the motion, and from the force of weight acting at right angles to the imparted motions, and in rubbing is as the surfaces, imparting and receiving motion.

The least friction is when polished iron moves on brass.—*Coulomb.*

The force of a man in turning a winch is taken at 116 lbs., or as much as would raise 256 lbs. 3281 feet in a day; his force in pumping is as 190, or equal to 419 lbs. in 3281 feet; in ringing 259, or 572 lbs. 3281 feet; and in rowing 273, or 608 lbs., 3281 feet.

Smeaton, a good authority, reckoned a horse equal to five men, and Bossuet seven men, and an ass to two men. A horse, says Desagulier, can draw 200 lbs. 2½ miles per hour, for eight hours per day, or 240 lbs. six hours. Smeaton says that a horse loaded with 224 lbs. can travel twenty-five miles in seven or eight hours.

The force of a horse per Desagulier, is 44000 lbs. 1 foot per minute.
Per Smeaton, 22916 ditto.
Per Watt, 33000 ditto.

Then, as Mr. Watt, in a steam engine, considers one fourth lost by friction, he takes Desagulier's 44000 lbs. as the horse power in his steam engine.

230 gallons on an over shot water wheel, a 6.12 inch steam engine cylinder, 1 horse, 5 men's power, windmill sails 17.89 feet, are all equal to raise 1000 lbs. avoirdupois thirteen feet in a minute.

1584 gallons, a cylinder 14.2 inches, ten horses, fifty men, or 56.57 feet Dutch sails, are equal to raising 1000 lbs. 130 feet in a minute.—*Fenwick.*

One bushel of good coals raise from twenty-four to thirty-two millions of pounds one foot per minute. Four bushels of coals per hour, with a cylinder of 31½ inches, and 17½ strokes of seven feet per minute, is a force equal to forty horses constantly. A rotative double engine, with a cylinder 23¾ inches, making 21½ strokes of five feet per minute, is a twenty horse power; and a cylinder 17½, making 25 strokes of four feet is a ten horse power: the consumption of coals being proportional.—*Watt.*

The common velocity of overshot wheels is three feet per second.

A man or horse will perform his labour with the greatest advantage, when the resistance is $\frac{4}{9}$th of his natural strength, and when his velocity is equal to $\frac{1}{3}$ of his greatest velocity when not impeded. The force of a man at rest is about 70 lbs. and his velocity six feet when not impeded, therefore his force is exerted to the best advantage by a resistance equal to 31 lbs. and a velocity of 2 feet per second; so with a horse, his greatest pull is 420 lbs., equal to 20 cubick feet of steam per minute, and his rate 10 feet a second, therefore his labour is best performed at 187 lbs. and 3 feet 4 inches per second.

A horse will draw 200 lbs. for eight hours, at 2½ miles an hour; and the strength of five men is equal to one horse. According to work or position a horse can perform the work of seven men, or only of three men, but five is taken as the mean.

The resistance in the same fluid to the same body is as the square of the velocity, because the number of atoms encountered is as the superfices of the moving body. The particular resistance of different fluids is to be determined by experiment. A ball which, without the resistance of air, ought to rise twelve miles, at 2000 feet per second, will ascend but 2920 feet. Resistance too, overcomes velocity, so as to render the velocity of falling bodies uniform, after moving through 8½ feet of water and 260 feet of air.

Horse power in steam engines is calculated as the power which would raise 33,000 lbs. a foot high in a minute, or 90 lbs. at the rate of 4 miles an hour. Some experimentalists estimate it at ⅓ less, but the above is adopted by most theoretical writers.

The force necessary to move a wheel carriage on a level road, is about $\frac{1}{2\frac{1}{5}}$th of the load, on a railway it is but the 150th. On a canal it is but the 600th.

Friction in drawing a body over a horizontal surface is equal to ⅛d or ¼th, and another writer makes it 7 to 20. Friction of wheels or cylinders is as the weights divided by the diameters. In pulleys the friction is reduced one half by grease. The general allowance in machinery is ⅓d for friction.

In wheel-machinery, to determine the number of revolutions of the last-moved part for one of the first-moved part, divide the product of the cogs in the driving wheels by the product of the cogs in the driven wheels.

The strength of an inch square of different kinds of wood pulled lengthways, has been determined as under:

Beech . . .	6000 lbs.
Oak . . .	7000
Alder . . .	5000
Ash . . .	6000
Fir	4000
Birch . .	4200
Walnut . .	5000
Cedar . .	5000

A piece of fir two inches in diameter bears 7 tons; a rod of iron, ⅛d of an inch diameter, 3 tons; and a hempen rope of the same size will carry 1000 lbs. The rule is as follows: square the diameter in inches or parts, and multiply for fir by 9, for rope by 22, and for iron by 106, the product is cwts. A six thread rope bears 631 lbs., and a nine thread 1014 lbs., a twelve thread 1564 lbs., an eighteen, 2148 lbs.

The lateral strength of bodies is as the area of the section. A piece of freestone requires 205 lbs. to pull it asunder, and the lateral strength of fir is 18 times less than its strength lengthways. Emerson determines that a rod of good oak one inch square, will for a short time bear in the middle 330 lbs. and permanently 207 lbs. The proportions for different substances of equal lengths and sizes are, oak and yew as 11, ash and elm as 8½, walnut and red fir 7, beech, birch, alder and white fir 6, iron 107, brass 50, bone 22, lead 6½, freestone 1; in regard to loads placed in their middle.

In resisting compression the strength of timber in a rod 4 feet long and $\frac{7}{10}$ths of an inch square is for fir 226 lbs., beech 146 lbs., and oak 86 lbs. Oak will bear a pressure of 4000 lbs. per square inch, but other experiments make it 3000 lbs. Short specimens give to oak a comparative power of resisting pressure of 12. Willow and fir 9, and ash, elm, and poplar 7.

The cohesion of cast iron is about 30000 lbs. per square inch.

Coulomb establishes that the resistance of fluids is as the velocity and cohesion or viscidity of the particles. And that as the resistance of oil to that of water is as 17.5 to 1, this is the law of their cohesion.

Water presses on the bottoms of vessels as the base by the height, whatever be the form or bulk of the height. This is the hydrostatick paradox; and, by the application of it, slender pipes are made to produce an extraordinary pressure at the base, for it is always as the base by the height.

The smallest quantity of water balances any quantity however great, on the principle of finding its

level; hence, if a long pipe be inserted in a butt of water, however small its bore, it will burst the butt as though it had been blown up with gunpowder. Bramah's press is made on this principle, and a column of water $\frac{1}{2}$ an inch diameter, acting on a square foot of water, produces 576 tons pressure, or upon a yard in diameter, of 41472 tons, and made to act so as to bear upon any substance. The weight of water depends on its height and not on its quantity, and this is called the hydrostatick paradox.

The quantity of water discharged through different apertures, with different heights of the fluid, is as the areas of the apertures and the square roots of the heights; but one-third more will be discharged through a pipe than through the aperture.

The centres of pressure of a fluid and of percussion, are $\frac{2}{3}$ds the height.

In levelling it is usual to allow the 10th of an inch in every 200 yards, or 8 inches in a mile; 6 feet in 3 miles; $10\frac{1}{2}$ feet in 4 miles; $15\frac{1}{2}$ in 5; 24 in 6; 66 in 10; 100 in $12\frac{1}{2}$; and 130 feet in 14 miles for the sphericity of the earth.

Projectiles independently of resistance, describe paraboliek curves.

In a Circle, calling D the diameter, C the circumference, A the area, and P 3.14159.

$$D = \frac{C}{P} \text{ or } \frac{4A}{C}, \text{ or } {}^{2}\sqrt{\frac{A}{P}}$$

$$C = P\,D \text{ or } \frac{4A}{D}, \text{ or } {}^{2}\sqrt{P\,A}.$$

$$A = \frac{P\,D^2}{4} \text{ or } \frac{C^2}{4P}, \text{ or } \frac{D\,C}{4}$$

$$P = \frac{C}{D} \text{ or } \frac{4A}{D^2}, \text{ or } \frac{C^2}{4A}$$

The following are the varied relations of forces: b the body, f the force, m the momentum, v the velocity, s the space, t the time. Then severally—

$$\text{as} = \frac{m}{v}, \text{ as } \frac{f}{v}, \text{ as, } \frac{m\,t}{s}, \text{as } \frac{f\,t}{s}$$

$$f \text{ as } m, \text{ as } b\,v, \text{ as } \frac{b\,s}{t}$$

$$m \text{ as } f, \text{ as } b\,v, \text{ as } \frac{b\,s}{t}$$

$$v \text{ as } \frac{m}{b}, \text{ as } \frac{s}{t}, \text{ as } \frac{f}{b}$$

$$s \text{ as } t\,v, \text{ as } \frac{t\,m}{b}, \text{ as } \frac{t\,f}{b}$$

$$t \text{ as } \frac{s}{v}, \text{ as } \frac{s\,b}{m}, \text{ as } \frac{s\,b}{f}$$

The *centre of gravity*, or of percussion, putting a for a line, joining the vertex, and the middle of the base is, in different bodies, as under; taken from the vertex:

A plain triangle, $\frac{2}{3}\,a$.
A right cone, $\frac{3}{4}\,a$

In a sector, as arch to chord, so is $\frac{2}{3}$ radius to the distance from centre.

In a sphere, segment of a sphere, spheroid, or conoid, the altitude being x, and the whole axis a.

The sphere, or spheriod is $\frac{4a-3x.}{6a-4x.}$

Hemisphere, or spheroid, $\frac{5}{8}\,x$.
Paraboliek conoid . . $\frac{2}{3}\,x$.
Hyperbolick conoid . $\frac{4a+3x.}{6a+3x.}$

The centre of gravity and percussion of any number of bodies, or masses, in a right line, is found by multiplying each body by its distance from some fixed point in the line, and dividing the sum of the products by the sum of the bodies, then the quotient is the distance from the point.

Or, if the bodies are not in one plane, a common plane must be assumed; and then the sum of the products of the bodies into their distances, divided by the bodies, is the distance of the common centre from the plane.

The *centre of oscillation* of a right-lined rod, is two-thirds of its length from the point of suspension.

In small ares, the vibrations of equal pendulums are performed in the same time. The times are as the square roots of the lengths. The lengths are as the squares of the number of vibrations in the same

time. An clastick pendulum, vibrating between semi-cycloidal cheeks, performs all its arcs in equal time. Compensation, or gridiron pendulums, are formed of steel and brass alternately, so as not to vary in length by temperature.

The distance of *the centre of gyration* from the axis of rotation is as follows:—

A right line in length $\times \sqrt{\frac{1}{3}}$.

Circle, or cylinder, about axis—Radius $\times \sqrt{\frac{1}{2}}$.

Circle about diameter—Radius $\times \sqrt{\frac{1}{2}}$.

Plane of a circle, about diameter $\frac{1}{2}$ Radius.

Surface of a sphere about diameter—Radius $\times \sqrt{\frac{2}{3}}$.

Solid globe, Radius $\times \sqrt{\frac{2}{5}}$.

Cone, Radius $\times \sqrt{\frac{3}{10}}$.

The equation of the parabola is $yy=p^x$; and, therefore, the squares of the ordinates are to each other as the abscess.

The equation of the hyperbola is $yy=\frac{bb}{aa}(tx+x^2.)$

The equation of the ellipse is $yy=\frac{cc}{tt}(tx-x^2.)$

The equation of the circle is $yy=dx-x^2$.

These four are curves of the first order, comprised in the general equation $o=a+bx+cy+dx^2+cxy+fy^2$.

Curves of the second order have, for their general equation, $o =$ as above; adding $+gx^3+hx^2y+kxy^2+ly^3$. And those of the third order, superadding $mx^4+nx^3y+px^2y^2+qxy^3+ry^4$.—$x$ and y being rectangular co-ordinates.

A *catenarian* curve is that formed by a chain, or rope, suspended at both ends. A *cycloid* is the curve formed by a point in a wheel, or body on the earth, which revolves and goes forward at the same time, and that in which all bodies fall. A parabola is the curve formed by water from a pump, or by a stone from a sling.

The head of a fish is a conoid, or the solid form of least resistance.

The cycloid is the curve line of swiftest descent, and is precisely the curve which the double motion of the earth generates in all falling bodies.

The hexagonal cells of bees present the greatest space with the least labour. The male cells are invariably 5-18ths of an inch, and female ones 13-60ths, always and every where.

A proportion, or ratio of two numbers, is greater or smaller as the quotient of their division is more or less. Thus 6 is to 2 in greater proportion than 6 to 3, because $\frac{6}{2}$ gives more than $\frac{6}{3}$. Hence $\frac{6}{2}$ or $\frac{a}{b}$, is the same as 6 : 2, or $a : b$.

If $a : b :: c : d$.

Then $a : c :: b : d$.

And $ad=cb$, or $\frac{a}{b}=\frac{c}{d}$

And $a+b : b :: c+d : d$

And $a-b : b :: c-d : d$

If b equal c

Or $a : b :: b : d$,

Then b is a *mean proportional* to a and d.

It is also a *third proportional* to a and ad.

And it has to c, a *duplicate ratio* of a to d.

Then also $ad = b^2$; and b is the square root of ad.

When a is to b as b to c, and c to d, and d to e, then a is a *triplicate ratio* to d, the third term; and a *quadruplicate* to e, the fourth term.

The sum of an arithmetical series is found by adding the first and last terms, and multiplying by half the number of terms.

Any term is the first term added to the additional number of common differences. If the first term is 3, and the common difference is 5, then the 12th term is $11\times5+3=58$.

When the first and last are given, any intermediate terms are found by substracting the two terms, and dividing by one more than the number of terms sought for the common difference. Thus if we want 6 terms between 5 and 40—then $40-6=\frac{35}{6+1}=5$; and 5, 10, 15, 20, 25, 30, 35; 40 is the series.

Every geometrical series being the continued multiplication by a fixed difference, the terms are, r being the difference a, ar, ar^2, ar^3, &c. to ar^n for n terms. The last term, therefore, is ar^{n-1}, because the first involves no power of r.

The sum of an ascending series is found by multiplying the last term by the common ratio—substracting the first term and dividing the difference by the ratio less 1.

The sum of a descending series is found by deducting the power of the ratio raised to the number of terms from 1, and dividing the difference by 1 less the ratio, and multiply this quotient by the first term.

And the sum of a descending *infinite* series is found by dividing the first term by 1 less the common ratio.

Logarithms, so useful in philosophy, are the arithmetical series in contrast with a parallel geometrical series, by which the multiplication of any two terms of one series corresponds with additions of the other. The Logarithms for PRIME Numbers, under 100, are as under, and others are formed from these by mere multiplications and additions:—

2— .301030	43—1.633469
3— .477121	47—1.672098
5— .698970	53—1.724276
7— .845098	59—1.770852
11—1.041393	61—1.785330
13—1.113943	67—1.826075
17—1.230449	71—1.851258
19—1.278754	73—1.863323
23—1.361729	79—1.897627
29—1.462398	83—1.919078
31—1.491362	87—1.939390
37—1.568202	97—1.986772
41—1.612784	

The Index is always one less than the number of digits in the whole numbers.

As examples of the use of the above, all the powers of each number are found by multiplying by 2, 3, 4, &c. Thus the Log. of 4 is twice that of 2; of 8 is thrice; of 16 is 4 times; and so on. And the Log. of 9 is twice that of 3, of 27 is three times, &c. So the multiplies of any two of the figures have the sum of their Logs. for their Log. Thus $2\times 7=14$, and the Logs. of 2 and 7 added, are the Log. of 14. This short table will, therefore, produce any desired Logarithm of any number.

Log. of the arc of a quadrant 1.57079=.196118.

Of the chord=.150515.

Of the circle, 6.283=.798180.

Of earth's rotation per second at the equator, 1525.46=3.183401.

Of earth's velocity per second, 97793 feet=4.990307.

Of distance from sun, 93.026240 miles=7.968605.

Parallax, 8″.7726=.943129.

Of days in a year=2.562592.

Of sec. in a day=4.935326.

Of moon's fall in her orbit per minute, 128814 feet=5.109963 (not 16 feet!)

The following is a brief view of some modern principles of physicks, published by the editor:

All phenomena are results of matter in motion, and motions are transferred *ad infinitum;* transfer being action, and reception re-action.

Space is occupied by atoms and masses transferring power to one another, so as to be a plenum of power, in bodies or atoms in regular motion.

Wherever there is power there is matter in motion, and wherever there is matter in motion there is power, directly as their multiple.

Vis inertia is the effect of contrary or obliquc motions, matter deriving all its power from motion.

Powers of attraction, repulsion, universal gravitation, projectile force, caloric, chymistry, sympathy, fluids sui generis, &c. &c. are inventions to conceal ignorance, being universally resolvable into some matter or matters in some motion or motions, the detection of which is knowledge.

Qualities of body and matter are mere variations of power or form, and always measured by relative material results of matter on matter.

Definite sizes and definite results of all kinds, are consequences of actions and reactions, arriving at limits by a law of simultaneous series, increasing and decreasing; hence, whatever is is fit, and what is not fit is not; and all actual and continued existence is, for the time, in general harmony.

The following new and original determinations, in addition to others under the heads ASTRONOMY and PHILOSOPHY, were made by Sir R. Phillips in 1831. Results only are given, and details are avoided in a work of this miscellaneous character:—

Bodies deflected at right angles to a system in progressive motion, rise with a force directly as the height attained, and inversely as the progression, and they return contrarywise. If the deflection is in the

quadrant of a sphere, the deflecting and returning force is inversely as the quadrant, and directly as the progression.

If the quadrant is part of a rotating sphere, the rotating periphery is the base of a sector, whose apex is the centre of the circle, and whose equal sides are the radii. But the areas of circles are $\frac{C \times D}{4}$, and the superficies of a sphere are $C \times D$; hence, in comparing the rotative force of any periphery with that of the whole sphere, or in using it as part of the whole, the periphery moved through must be multiplied by 4. But if the sphere is not true, as in the earth, then by its proportion to a true sphere, and for our oblate spheroid, the multiplier is 3.98406.

But as the peripheries are the bases of areas described in different times, so, in comparing their forces for different times, their squares must be compared, or as the motions are multiples of the times, the squares of the times may be adopted. Then as central force or falling is for a second $\frac{O}{4\,R}$, for other times it is as $4\,R^2$ or T^2. This ratio of areas described by the peripheries, is therefore the true cause of the laws of acceleration traced by Galileo, and not the motion added to motion as has been plausibly alleged. Taking $\frac{O}{4\,R}$, for the fall for any time, or $\frac{O^2}{4\,R^2}$ for the square of the fall, the fall for other times is as R^2 is to the fall for that time, so is R^2 for another time to the fall for that time. Thus, if 1525 feet in 1 second give 16.085 feet of fall, 3050^2 give $\frac{1525^2}{2^2}$ 64.34 feet of fall, or $\frac{1525^2}{2^2}$, for half a second give 4.02125 feet of fall. But the square of the times 1, 2, $\frac{1}{2}$, &c. is equivalent to R^2, so we may substitute these for R^2, though the square of the periphery in the time, or the motion of areas, is the cause of the phenomenon.

The earth turns on its axis because it is deflected from a right line in one tangent to another, whose angles, in 24 hours, vary 59".136; the sine of which is 172 to the whole force, whose sine 10000 carries it, in 24 hours, through a distance equal to 64.33 circumferences. Then as 10000 : 64.33 :: 10172 to 65.44 one circumference more, owing to the deflective force 172. And this force acts on the outer hemisphere because a body moves only in the direction in which it is impelled, and an extra force on one hemisphere would produce rotation. Thus all planets and the sun itself rotate, and rotation is evidence of falling from one tangent to another. In the moon, the tides of the earth are the compensating force. The inclination demands an increase as 1.077 to 1., and reduces 65.44 to 65.35. In a quadrant = 5876 circumferences, the 64.33d is 91.31 extra rotations.

The vibrations of a pendulum are diminutive representations of the earth's motions, and the length of a pendulum for a second is directly as O^2, and inversely as $4^2 \times 6.283^2$. As R or 4 varies from the mean of a true sphere at the place, the pendulum is longer or shorter. For other times, it is governed by the ratio of R^2 and O^2 in a second to R^2 and O^2 in the other time. The length of the pendulum, determined by observation, enables us therefore to determine the exact values of O, R, or 4, the figure of the earth, any two being given; for the areas described by the pendulum exactly mimick the areas described by a radius of the earth by its rotation.

As the oblate figure of the earth depends on the variation of 4; and as in the equation $\frac{O^2}{4\,R^2 \times 6.283^2} = P$, we have $\frac{O^2 \times P}{R^2 \times 6.283^2} = 4$, more or less; so may we find the ratios of the two diameters by comparing it with a true circle. It is as 4 to 3.98406. The *cause* is the unequal force of the outer hemisphere, which lengthens the cosines, for the orbit in that case would not be the exact centre of the force of both hemispheres, and the poles would be flattened about 16 miles by that small difference in the equatorial force.

The eccentricity of orbits, and the advance of the line of apsides, arise

from the extra rotation of the earth, or any planet, while performing its orbit. Then the orbit motion, during a rotation of the earth, is 1,600,290 miles; but to readjust the orbit without enlargement, the whole quantity is given to the radius, first *positively*, and then it is abstracted *negatively*, by which the 1,600,290 miles in the orbit are neutralized, and the orbit affected only by an advance of the apsides equal to the substantive circumference of the earth in the ecliptick. The positive and negative results are effected by the alternate tangental action of the outer hemisphere, in passing from the perihelion to the aphelion, to the limit of the forces; and by the chordal action of the inner hemisphere in passing from the aphelion to the perihelion. But for this truly sublime economy, the extra rotation would enlarge the orbits in every revolution by 1,600,290 miles. The true eccentricity on 93 millions distance is 1,558,870 miles, or as 1 to 0.01685; and if the advance of the apsides, &c. is added in measure, it would be exactly equal to the extra day's motion. Of course, every increment of an orbit is part of a series of concentrick circles, of which the sun is the constant centre. The egg-form is a mere picture or hieroglyphick history of the orbit. If planets were points, they would perform exact circles; but definite bulks give two degrees of force to their inner and outer hemispheres, whose motions running into each other alternately prevail, and hence the variation in orbit and centre as described.

Kepler's law should be $T^2 : t^2 :: D^{3.1416} : d^{3.1416}$. It has not hitherto been understood; but it arises from the Times being circles, which are *involved* with forces; and then the force, or power, being first extracted, the root is the circle in the usual relations of circles to the radii. The power of the force in a quadrant is 1.5708, and the Time is the circle $^{1.5708}$; that is $T = C^{1.5708}$, therefore $T^{\frac{1}{1.5708}} = C$. The true ratio therefore is $T^{\frac{1}{1.5708}} : t^{\frac{1}{1.5708}} :: D : d$. But to give an expression like Kepler's, since $\frac{1}{1.5708} = \frac{2}{3.1416}$, and the denominator of the coefficient may be carried to the last terms without changing the proportion, T^2 is to t^2 as $D^{3.1416}$ to $d^{3.1416}$. The roots and powers are, of course, attained by dividing or multiplying the logarithms. Mercury, by this corrected ratio, comes out 37,593,000 miles; Venus, 68,254,630; and the other planets slightly more than usual.

The two forces which move the planets are the defleetive force from the line of the sun's motion, produced by the sun's rotation on his axis and around the centre of momentum of the system which carry or urge the medium of space into circles, and these act tangent-wise on the planets as 1.2114; and the returning force by which they follow the sun in the whole moving system as 1—between the two performing a resultant motion of 1.5708 in a quadrant, and a return to the line in the next quadrant.

Since neither the sun nor any matter has power without motion, so in the sun's great power we have evidence of great progressive motion. Then the rotation of 6619 feet per second, demands a velocity of 26,476 feet, to render the centripetal merely equal to the centrifugal force. Again, rotation is itself evidence of falling from a tangent into an orbit. Herschel, by observation, thought the sun somehow moved towards Hercules, with the velocity of the earth, or 100,000 feet per second. It is therefore now inferred, that the sun actually describes a great orbit round some undiscriminated centre; and Sir R. Phillips analogically has estimated the size of this orbit on three degrees of central force. With equal centripetal and centrifugal at 162,865 millions; with 4.02 feet of fall per second at 654,722 millions; or, with 16.085 of fall at 2,619,750 millions; performed in each case in exactly 25,868 years, the period of the precession of the equinoxes, which he considers as the true period of the solar orbit. Hence the changes of 50″.1 per annum in the phenomena of the earth and stars, or of a degree in 72 years; and hence the whole of the stars go apparently round in 25,868 years. Of course, the planets as to the sun are therefore like satellites.

The three approximating quantities, the apsides' progression, the earth's circumference, and the precession, have been connected at col. 620; but the theory of a solar orbit rendering the precession its measure, the apsides' progression alone appears to arise from the acceleration of the earth's extra rotation. The period is 20,910 years, and the annual angle 61″.916, equal to 27,925 miles in the earth's orbit. Then 24,894 equatorial measure of the earth would be, in the ecliptick, 26,812; and adding increase on increase a 47th for the moon, and effects of variable distance, the 26,812 would become 27,925. At the same time, this is a period of modern observation, and may be subject to variations, owing to the solar orbit, while the precession, or solar orbit of 50″.1, was well known to the ancient Hindoos; and, as now appears, arises from the fixity of the axis from terrestrial structure, while the stars pass the nodes, or the nodes appear to fall back, owing to the earth's progression along with the sun in the grand solar orbit.

Another means of determining the sun's distances, besides those described in articles ASTRONOMY AND PHILOSOPHY, is to divide the orbit motion found by the fall in a second, by 1.57079, which gives the proportion of the radius, and then multiplying by the seconds, in which a quadrant is performed, it gives 93,026,240 as the mean distance.

Tables of Decimals:—

1*s.* is .05 of one pound.
1*d.* is .0041666 of one pound.
1 farthing is .0010416 of a pound.
1 inch is .08333 of a foot.
1 lb. is .008928 of a cwt.
1 oz. is .000558 of a cwt.
1 yard is .000568 of a mile.
1 inch is .0000158 of a mile.
1 day is .002739 of a year.
1 minute is .000694 of a day.
1 dwt. is .004166 of a lb. troy.
1 grain is .000173 of a lb. troy.

Decimals of Fractions.

$\frac{1}{2} = .5$	$\frac{1}{5} = .2$
$\frac{1}{4} = .25$	$\frac{2}{5} = .4$
$\frac{3}{4} = .75$	$\frac{1}{7} = .142857$ &c
$\frac{1}{8} = .125$	$\frac{1}{9} = .1111$ &c.
$\frac{3}{8} = .375$	$\frac{1}{11} = .090909$ &c.
$\frac{5}{8} = .625$	$\frac{1}{12} = .08333$ &c.
$\frac{7}{8} = .875$	$\frac{1}{16} = .0625$
$\frac{1}{3} = 333$ &c.	$\frac{1}{20} = .05$
$\frac{2}{3} = .666$ &c.	$\frac{1}{24} = .041666$ &c.

Tables of sines and tangents, and of natural sines and tangents, are not always accessible; the following proportions between the sides of triangles whose hypothenuse is 1000 for every two degrees, may therefore be useful.

Angle Degrees.	Sine or Perp.	Cos. or Base.
1	17	999
3	52	998
5	87	996
7	121	992
9	156	983
11	191	982
13	225	974
15	259	966
17	292	956
19	326	946
21	358	934
23	391	920
25	423	906
27	434	891
29	485	875
31	515	857
33	545	839
35	574	819
37	602	799
39	629	777
41	656	754
43	682	731
45	707	707

For the next 45 degrees they are to be taken conversely, or base and cos. for perpendicular and sine. Intermediate degrees, or parts of degrees, may be found, without material errour, by the mean proportional: for example, 55 degrees, ten more than 45, is equal to ten less, or 35 degrees, the base being taken as the perpendicular; and if 36 degrees were wanted, 574 added to 602 is 1176, the half of which is 588, which is the perpendicular for 36 degrees, or the base for 54 degrees, and so the half of 36 and 35 would be $35\frac{1}{2}°$ and $54\frac{1}{2}°$.

A pump 10 feet above a well, with 7 inches bore, will discharge 70 gallons a minute; and at 30 feet and 4 inches, 23 gallons.

In the Roman notation, Iↀ or D, stood for 500; and C after them, for as many hundreds as C's; CIↀ, or M, was 1000, with C's for odd hundreds. M, with a dash over it, was one

million; X, with a dash over it, 10,000. The ↄ is tenfold the number to which it is added.

The length of strings and vibrations in a second of time, of the eight notes and four semitones of an octave, are—

	Length.	Vibrations.
C	500	480
B	530	453
B flat	561	428
A	595	404
G sharp	630	381
G	667	360
F sharp	707	339
F	749	320
E	794	302
E flat	841	285
D	891	269
C sharp	944	254

C again being 1 and 240

Some writers assign 30 as the lowest, and 14000 as the highest number of distinguishable vibrations in a second, in producing tones on musical strings.

Rate of Interest, in even shillings, at different prices of 3 per cent. consols:

91½ to 93	3*l.*	5*s.*
90¼ to 91½	3*l.*	6*s.*
87⅞ to 90¼	3*l.*	7*s.*
87½ to 88⅞	3*l.*	8*s*
86⅞ to 87½	3*l.*	9*s.*
85⅛ to 86⅞	3*l.*	10*s.*
84 to 85⅛	3*l.*	11*s.*
82¾ to 84	3*l.*	12*s.*
81⅝ to 82¾	3*l.*	13*s.*
80½ to 81⅝	3*l.*	14*s.*
79½ to 80½	3*l.*	15*s.*
78½ to 79½	3*l.*	16*s.*
77½ to 78½	3*l.*	17*s.*
76½ to 77½	3*l.*	18*s.*
75½ to 76½	3*l.*	19*s.*
74½ to 75½	4*l.*	0*s.*
73½ to 74½	4*l.*	1*s.*

Higher or lower rates may be estimated from the above, by adding or substracting.

When the stocks yield 4 per cent., government sell an annuity of 20*l.*, for 10 years, at 163*l.* 10*s.* 3*d.*; for 20 years, 273*l.* 11*s.* 1*d.*; 30 years, for 347*l.* 12*s.* 2*d.*; 40 years, for 397*l.* 8*s.* 11*d.*; and, 50 years, for 430*l.* 19*s.* 8*d.*; or for life, at 15, for 362*l.* 14*s.* 8*d.* males; or 383*l.* 11*s.* females; at 30, for 331*l.* 19*s.* 7*d.* males; and 351*l.* 14*s.* 6*d.* females; at 60, for 198*l.* 14*s.* 4*d.* and 229*l.* 6*s.* 11*d.*; and in proportion to price of stocks as above.

Half the length of a second's pendulum multiplied by 9.87 is the fall of a body.

Two pendulums at Paris made 85922.06 and 85933.83 vibrations in a mean solar day. And the same in London gave 85933.29 and 85945.85; 12″ being the increase in London.

A leaden ball fell from the cupola of St. Paul's to the pavement, 272 feet, in 4.25″, which squared, is 18.06; then $\frac{272}{18.06} = 15$ feet per second. But 17 feet being allowed for resistance, it is taken as $\frac{289}{18.06} = 16$ feet per second in air; and as 16.08 is vacuo. A hollow glass globe was 6″ in falling the same height.

The seconds pendulum, in London, is 39.12 inches; at the equator, 39.027; and 45°, is 39.111; and at 75°, is 39.187. The same principle makes it, at the poles, 39.197.

Eclipses return in the very same order every 18 years and 11 days, supposing four leap-years in the interval; and, if five, then 10 days. Other cycles of motion, however, vary the phenomena or measure. The moon's shadow is less than 170 miles broad; but the eclipse is visible, in degree, for 2000 miles: 500 miles diameter gives 11 digits, and then a digit less every 250 miles.

The Eclipses of the sun for this century, visible in England, are as under:

July 17, 1833, at 7 in the morning.
Feb. 21, 1841, at 11 ditto.
July 18, ——, at 2 afternoon.
May 6, 1845, at ½ past 10 morning.
May 17, 1863, at 5 afternoon.
Oct. 8, 1866, at 5 afternoon.
Dec. 31, 1880, at 2 afternoon.
Mar. 27, 1895, at 10 morning.

The principal Eclipses of the moon, *i. e.* total, visible in England will be as under:

July 2, 1833, at 1 morning.
Dec. 26, 1833, at 10 afternoon.
April 20, 1837, at 9 afternoon.
Oct. 13, 1837, at ½ past 11 afternoon.
Nov. 24, 1844, at 12 at night.
Oct. 13, 1856, at ½ past 11 afternoon.
June 1, 1863, at 12 at night.
July 12, 1870, at 11 afternoon.
Feb. 27, 1877, at ½ past 7 afternoon.
Aug. 23, 1877, at ½ past 11 afternoon.
Oct. 4, 1884, at ½ past 10 afternoon.
Jan. 28, 1888, at ½ past 11 afternoon
Nov. 16, 1891, at ½ past 12 morning

May 11, 1892, at ½ past 11 afternoon.
July 3, 1898, at ½ past 9 afternoon.
Dec. 27, 1898, at 12 at night.

The two next transits of Venus will be in December 1874 and 1882.

Longitude is converted into time, by calling every 15 degrees an hour, $(\frac{360}{24})$ every degree 4 minutes of time $(\frac{60}{15})$ and every 15 minutes of a degree, one minute of time.

Fall of Bodies in 12 parts of seconds.		*Inches.*
$5''' \times \frac{193}{144}$	=	1.34
$10''' \times \frac{193}{36}$	=	5.36
$15''' \times \frac{193}{16}$	=	12.06
$20''' \times \frac{193}{9}$	=	21.44
$25''' \times \frac{193}{576}$	=	33.64
$30''' \times \frac{193}{4}$	=	48.25
$35''' \times 193 \times .3403$	=	65.68
$40''' \times 193 \times .444$	=	85.69
$45''' \times 193 \times .5625$	=	108.56
$50''' \times 193 \times .7$	=	134.01
$55''' \times 193 \times .84$	=	162.12
$60'''$ or $1'' \times 193 \times .1$	=	193. 0

The interseetion of three lines, drawn from the angles of a triangle, to the middle of the opposite sides, is its centre of gravity and percussion. If the lines biseet the angles, it is the centre of the inscribed cirele; and if perpendiculars to the opposite, the intersection is the eentre of the eireumscribing circle.

Cannon-balls moving 1600, 1200, 1500, and 1060 feet per seeond, or near the mouth of the gun, penetrated elm 20 inches, 15, 30, and 16 respeetively; oak at 1200, 34 feet; and earth at 1300, 15 feet. The balls were from 2 inches to 5½ in diameter.

In sandy soils, the greatest force of a pile-engine will not drive a pile above 15 feet.

Olive oil at 0° diminishes to 32° by .0162, and inereases at 72° by .0229th; and at 175° by .0971.

The differential calculus of Leibnitz finds a small quantity, whieh taken an infinity of times is equal to a required quantity; and fluxions eonsider momenta as quantities. One is expressed by d, as $d\ x$, and the other by a dot, as $\dot{x}$.

An inerease of 2 per eent. in every 10 years would double mankind in 350 years. An inerease of 5 per cent. in 142 years, and of 10 per cent. in 73 years, of 32 per eent. in 25 years. So with decrease, and, if a population doubled in any period, it would in past time have been in the same period, but half, a fourth, &c. a eonsideration which proves the fallacy of the modern population theories.

A landscape in perspective should not include more than an angle of 60 degrees, or one sixth of the horizon. All lines perpendieular to the pieture or perspeetive plane, vanish in the point of sight, and the size of objeets is therefore inversely as their distanee.

The *vernier* seale is 11-tenths divided into 10 equal parts, so that it divides a scale of 10ths into 100ths, where the lines meet even in the two seales.

A man five feet six inches high, on the sea-shore or on level ground, ean see about three miles distant.

Cassini's meridian line, at Bologna, is 120 feet long.

St. Paul's London, is 5′ 47″ W. of the Observatory, Greenwich.

A fall of one-tenth of an inch per mile will produee a motion in rivers. The greatest veloeity is at the surface and in the middle, and the least at the bottom and sides. But as the veloeity increases, the aetion on the sides and bottom inereases also. The mean velocities are as the area of the sections.

Numbers whose digits are divisible by 3, are as totals divisible by 3. Numbers of 3 places, in aseending arithmetical progression, are divisible by 3. In like manner any total composed of series in 3, or its multiplies 6, 9, or 12 with equal differences, are divisible by 3.

The square of every number, ending with 5 or 0, is equal to 2 square numbers, divisible by 3 and by 4.

To determine the number of fixed atoms in any bulk by their downward tendency, the hydrometer is a very convenient instrument, and it

gives the specifick gravity within the 40,000th part. In other cases, on being weighed in and out of water, as the lost weight in, is to that out, so is the specifick gravity of water to that of the body.

One link of a surveyor's chain is 7.92 inches, and a chain of 100 links is 22 yards, 10 chains being a furlong, and 80 a mile. 625 links, or 30¼ yards, is a pole or perch, 40 poles is a rood, and 4 roods, or 100,000 links, or 10 chains, or 4840 yards is an acre.

In cross multiplication 12 fourths is a third, 12 thirds is a second, and 12 seconds an inch. Feet into inches are inches, and into seconds are seconds; inches by inches are seconds, and by seconds are thirds; seconds by seconds are fourths.

A hide of land was 100 or 120 acres, and 5 was a knight's fee. Doomsday book reckoned 243000 hides in cultivation.

A standing tree is measured by squaring ¼th of the girth, and multiplying it by the height of the trunk.

The length of any arc of a circle is found by multiplying the degrees in the arc by 3.1416 times the radius, and dividing by 180.

The area of a triangle whose sides only are given, is found by taking half their sum, substracting each side, and then multiply the half continually by the three remainders, and the square root of that product is the area.

The area of a circle is the product of the diameter and circumference divided by 4.

To find the area of a spherical triangle, multiply the difference between the sum of its three angles and two right angles by the radius of the sphere.

To find the area of the segment of a parabola, multiply the base by the length, and take ⅔ds.

For an ellipsis, multiply the product of the two axes by .7854.

For the solid contents of a cylinder, the area of the base by the height. For a cone or pyramid, it is one-third.

For the area of spheres or parts, the circumference by the height, whether sphere, zone, or segment.

The solidity of a sphere is ⅔ds of the circumference by the diameter; or the cube of the diameter by .5236.

A paraboloid is the area of the base by the height and half the product.

A spheroid is the multiple of the fixed axis by the square of the revolving axis, and by .5236.

The area of a circle whose diameter is one, is equal to a square whose sides are .88622692: and the square whose sides are 1, is equal to a circle whose diameter is 1.112837917.

Neper's and Brigg's Logarithms.

Nos.	Neper's log.	Brigg's log.
1	0,000000	0,000000
2	0,693147	0,301030
3	0,098612	0,477121
4	1,386294	0,602060
5	1,609438	0,698970
6	1,791759	0,778151
7	1,945910	0,845098
8	2,079441	0,903090
9	2,197225	0,954240
10	2,302646	1,000000

Dr. Hutton, assuming the principle or miracle of attraction, computed the earth's total density to be 5.24 times that of water, or half that of silver; then La Place, to reconcile attraction to facts, estimated the sun as ebony; Mercury equal to fluid quicksilver; Venus to Zinc; Mars to diamond; Jupiter to milk; Saturn to fir; and Herschel to amber!

To square the circle nearly, for the use of mechanics, draw diameters of the circle at right angles to each other, and produce them each way, beyond the circle, till the produced part of each diameter is equal to one-fourth of the radius; and the four points, when conjoined, form a square nearly equal to the area of the circle.

A mechanical and universal rule of proportion, founded on cross multiplication, of the products of contrary cause and effect being equal, answering by one direct, easy, and general method, every thing that can be resolved by the direct, inverse, and every way compounded, rule of three.—1. Set down, in the first part of a first line, all the leading terms or conditions of a question, in any order, considered as the first cause, with the word or words of affection thereto; then set down, in the second part of the first line, the following terms or conditions, in any order, considered as the first effect produced by the first cause.—2. Set down, in the first part of a second

line, at some distance from, and directly under the terms of the first line, the second like preceding terms or conditions each under each, in the same order with those above them, considered as the second cause, with the same word or words of affection as before; and then set down, in the second part of the same line, the second like following conditions, each under each, in the same order with those above them, considered as the second effect produced by its preceding or second cause; always marking the term sought, in this second line, where it is found deficient, by a star, or asterisk.* Put unity for a term only understood.—3. Draw contrary or cross lines; *i. e.* from the terms in the first part of the first line to the terms in the second part of the second line; and from the terms in the second part of the first line, to the terms in the first part of the second line.—4. Multiply the term or terms in the part of the second line wherein the star term is found, (whether in cause or effect,) into the contrary terms in the first line, (standing at contrary ends of the same cross lines) for a divisor.—5. Multiply, also, all the terms together, standing at contrary ends of the other cross line, for a dividend.—The quotient arising from this divisor and dividend, after reducing the fraction to its least or lowest terms, by dividing the dividend and divisor by different equal quantities, will give the true answer in all cases whatsoever.

Always state the question so, that the first and third terms given may be of the same name, when the fourth term sought will be of the same name with the second. The rule is, if *more* be required to mark the less extreme, if *less* to mark the greater extreme, for a divisor and to multiply the other terms together for a dividend, when the quotient will be the answer.—*Heath's Palladium*, 1767.

A cubick foot weighs as under:—

Porphyry	*lbs.*179	Derbyshire	*lbs.*145
Gray Granite	171	Tafa	76
Marble	172	Pumice	38
Portland	151	Brick	97
Yorkshire	156		

The weight to crush porphyry is 640,000 lbs.; gray granite, 165,000; marble, 100,000; Portland stone, 82,000; and brick 34,000 to 14,000 per foot.

The specifick gravity of water at 5° is .9998; at 34 and 44° is .9994; at 39° is 1; at 54° is .99951; at 90° is .99511; at 100° is .99313; at 182° is .969; and at 210° is .95848. The expansion being at 34 and 44° from .00002 at 1° to .00005; at 100° being .00692; and at 212° being .04332. From 39° it expands both ways.

SPECIFICK GRAVITIES.

Agate, oriental	2.8
Alabaster, white	2.73
Amber, yellow	1.078
Antimony	6.72
Barytes	4.4
Basalt	2.98
Bismuth	9.8
Bone, ox	1.656
Box	1.03
Brass	7.824
Brick	2.
Butter	0.9423
Cedar	0.56
Chalk	2.252
Cinnabar	7.786
Cobalt	7.645
Coal	1.308
Copper	7.7
Cork	0.24
Diamond	3.52
Ebony	1.29
Elm	0.671
Fat of beef	0.9232
——— mutton	0.9235
Feldspar	2.5
Fir	0.6
Flint	2.59
Garnet	4.085
Glass, Crown	2.52
——— Flint	3.00
——— Plate	2.71
——— Bottle	2.732
Gold, pure	19.2587
—— Sovereign	17.629
Granite, red	2.654
——— gray	2.728
Gunpowder	0.836
Gypsum	2.167
Honey	1.45
Hornblende	3.6
Jasper	2.69
Iron, fused	7.2
——, bar	7.68
——, magnetick	4.52
——, stone	4.323
Ivory	1.825
Lead	11.352
——, black	5.77
Lignum Vitæ	1.33

Limestone	1.386 and 2.72
Mahogany	1.06
Magnesia, Hydrate	2.33
Manganese	6.85
Marble, Carrara	2.716
Mercury at 60°	13.58
——— solid, 40° below 0	15.612
Nickel	9.33
Nitre	1.7
Oak	1.17
Pearls	2.683
Peet, hard	1.329
Phosphorus	1.714
Platina	20.722
Porcelain, China	2.38
Porphyry, green	2.676
Pumice stone	0.9145
Quartz	2.647
Rock crystal	2.653
Ruby	4.283
Serpentous	2.43
Silver, virgin	10.474
Silver, shilling	10.534
Slate clay	2.67
Spar, fluor	3.156
Stalactite	2.324
Steel	7.84
Stone, paving	2.416
———, grinding	2.143
Sugar, loaf	1.606
Sulphur	2.033
Tin	7.17
Tin, hammered	7.519
Topaz	4.01
Tungsten	4.355
Wax, Bees'	0.9648
Zinc, pure	7.1908

FLUIDS.

Acid, Nitrick	1.27
——, Muriatick	1.94
——, Sulphurick	1.84
Alcohol	0.837
———, do. pure	0.829
Beer	1.034
Blood, human	1.054
Cider	1.018
Ether, Sulph.	0.73
——, Nitrick	0.908
Milk, women's	1.02
——, cow's	1.032
Oil, Olive	0.9153
—, Linseed	0.94
—, Whale	0.9233
Turpentine, spirits	0.87
Urine	1.02
Vinegar	1.025
Water distilled	1.000
———, sea	1.026
———, spring	1.0017
Wine, Port	0.997
——, Sherry	0.992
Wine, Claret	0.994

GASES.

Air (1.2 water 1000)	1.000
Nitrous acid gas	3.176
Chlorine gas	2.47
Nitrous oxide	1.614
Carbonick acid	1.512
Sulphuretted hydrogen	1.19
Oxygen	1,104 and 1.0359
Nitrous gas	1.094
Olefiant	0.978
Azote	0.969
Carbonick oxide	0.957
Steam	0.6235
Ammoniacal	0.59
Carburetted hydrogen	0.555
Phosphuretted hydrogen	0.435
Hydrogen	0.074 and 0.0721

THE ANIMAL KINGDOM.

Animal organizations consist of ten classes, depending on their bony structure, their warm or cold blood, their mode of rearing their young, lungs or gills, and having bony or no bony parts.

1. MAMMALIA have a double heart and warm blood, with an internal bony skeleton and brain, and they suckle their young.

2. BIRDS have the same, but do not suckle their young.

3. REPTILES have lungs, and jointed or divided members, but a single heart and cold blood, with a brain and cartilaginous skeleton.

4. SERPENTS have lungs, and a single heart and cold blood, but no jointed members, with a brain and skeleton.

5. FISHES have gills and fins, and no lungs, with a single heart and cold blood, with a brain and bony or cartilaginous skeleton; and no jointed or articulated members.

All these having vertebræ, are called VERTEBRAL ANIMALS.

But the following have no internal skeleton, and no brain, as—

6. CRUSTACEA, with articulated members, and a circulatory system, with gills or branchiæ.

7. INSECTS, like the former, but with trachiæ and no circulating system.

8. MOLLUSCA, with simple nerves;

9. Worms, with knotted nerves.

10. Zoophytes, with no nerves and no vessels, but without articulated members, and no skeleton or brain.

The last five are, therefore, called Invertebral Animals.

The Linnæan arrangement embraces Minerals, Vegetables, and Animals, in Classes, Orders, Genera, Species, and Varieties, with names and characters.

In Animated Nature he has six classes, consisting of Mammalia in 7 orders, 47 genera, and 577 species; Aves, 6 orders, 90 genera, and 2641 species; Amphibia, 2 orders 19 genera, and 366 species; Pisces, 6 orders, 66 genera, and 889 species; Insecta, 7 orders, 131 genera, and 10896 species; and Vermes, 5 orders, 118 genera, and 4036 species. In all 19405 species.

Mammalia are divided into 13 orders by Cuvier, 10 by Blumenbach, and 7 by Linnæus.

Linnæus distinguishes birds into 6 orders: *Accipitres*, angular projecting beaks; *Picæ*, compressed beaks, with climbing feet; *Ansares*, beak with skin, and broad at end; *Grallæ*, with three or four toes; *Gallinæ*, convex bill and arched upper mandible; *Paperes*, conick and pointed bills.

Birds are divided by Cuvier into 6 orders, by Blumenbach into 8, by Linnæus into 6.

Insects are divided by modern entomologists into 680 genera, and every genus into many species. The study of each genus, its habits, economy, and wonderful ingenuity, according to its powers and the sphere of its existence, has afforded employment for years; and this branch of nature alone is so infinitely varied as to render the life of man unequal to its perfect knowledge.

Linnæus adopted 5 orders, defined by the wings—1. Coleoptera, with covered wings; 2. Angioptera, uncovered wings; 3. Hemiptera; 4. Aptera; and, 5. Vermes. This system he afterwards varied as follows:—

Order 1, Coleoptera, as beetles.

Order 2, Hemiptera, as bugs, locusts, and cockroaches.

Order 3, Lepidoptera, as butterflies and moths.

Order 4, Neuroptera, as dragon flies.

Order 5, Hymenoptera, as bees and saw flies.

Order 6, Diptera, with two wings, as gnats, flies, gad flies, &c.

Order 7, Aptera, without wings, as fleas, lice, spiders, mites, centipedes, crabs, &c.

Fishes are, by Linnæus, divided into five orders: Abdominales, Apodes, Cartalaginii, Ingulares, Thoracaei. Air is as necessary to them as to animals, and they respire in sleep twenty-five times in a minute. The air is extracted from the water by an apparatus called *branchial*, small, but extensive when spread out. They die in water deprived of its air, under ice, or on having their gills tied up.

Amphibia are cold blooded, and their lungs and heart are differently formed from warm blooded animals. Their lungs are like bladders or membranes, and the heart has only one ventricle, with a vein to convey it in and an artery to carry it out.

Their limbs and tail destroyed, grow again. They are torpid in winter, freeze with and in water, and revive when it melts. Frogs do not procreate till four years old, and tortoises live from one to two hundred years. Toads revive after being buried in rocks for countless centuries. Only a sixth of known serpents are poisonous.

Amphibia are divided into two orders, *Reptiles* and *Serpents;* and there are four genera of reptiles, testudo, draco, lacerta, and rana; and nine of serpents, crotalus, boa, coluber, angeris, amphisbœna, caecelia, achrocordus, hydrus, and langaya.

Some amphibia have branchæ like fishes, and lungs like land animals. The larvæ of frogs and some other species are thus formed.

Humboldt makes the species of insects 44000, of fishes 2500, reptiles 700, birds 4000 and of mamiferous animals 5000.

Adamson's great work on Natural History contained an arrangement of 40000 species, with a vocabulary of 200000 words, and 70000 figures drawn from the three kingdoms of nature.

Swammerdam, a Dutch philoso-

pher, printed his great work on insects in 1669. He divided insects into four classes, as spiders, &c. which include the modern classes crustacea, myriapoda, arachnoida, and acari. His second class consisted of those who appear perfect on leaving the egg, and have no wings till they shed their skin, and it includes the orthoptera, dermaptera, dicteroptera, hemiptera, and some of the neuroptera. In his third class he includes those hatched, as caterpillars, which change into a chrysalis, and remain so till perfect; it includes the coleoptera and aptera. His fourth class includes those who, on attaining their pupa state, retain their skin, as the hymenoptera and diptera.

Ray's work on Insects was published in 1712. He adopted two divisions, those which undergo no change, and those which pass through the state of larva.

Valasnieri, in 1730, distributed insects into four groupes. 1. Those who live on plants. 2. Those who live in water. 3. Those who live among stones. And 4. Those who subsist on animal remains.

In 1780, Mr. Drury formed a museum of 11000 species of insects, giving sixpence for all that might be brought him. It was afterwards sold for 600*l.*

Donovan's valuable work on British Insects extends to eighteen volumes.

Professor Martin published an account of 500 species of coleopterus insects found in England. M. Francilee collected 2000 species of the genus scarabacus. Mr. Jones, in 1794, announced a history of the genus papilio, in which he professed to describe 1400 species, 1000 of which he alleged he had seen.

The tusk or tooth of the male elephant, harder than horn and less brittle than bone, weighs from 120 to 200 lbs., and is brought from Ceylon and Africa. 100 parts contain 24 gelatine, 64 carbonate of lime.

Young elephants and females have no tusks, but are often killed in wantonness. The teeth imported have generally been found in the woods. Elephants are from nine to twelve feet high. They swim with ease, and live on vegetables. They respire and eat and drink through the trunk, which is so sensible as to pick up a pea or a pin. The young are three feet high, and the female seldom has twins. They grow for 30 or 40 years, and live 200 or 300, some say 400 years.

Under the genus Felis, Linnæus classes the lion, tiger, panther, leopard, ounce, ocelot, cat, serval, lynx, and caracal.

There are 2500 known species of fishes.

There are 69 genera of acarides or mites.

The rhinoceros is twelve feet long, with a horn three feet, and a skin so hard as to turn a sabre. They are solitary, and perfectly harmless, living entirely on vegetables. They are believed to be the unicorn of the Jews. One species has a smaller horn.

Pliny and others relate that Attilius, a Roman general, killed a serpent 120 feet long, near Utica.

Bears are of three species, totally distinct in their characters and habits. The black bear is a docile, harmless creature, living on roots and fruits, and mischievous only to bees, being very fond of honey. The brown bear on the contrary, is carnivorous and ferocious to other animals, but never attacks man unless first attacked. The white bear is often 12 feet long, ferocious in defence of its young against the more ferocious attacks of sailors, but preying chiefly on fish, and occasionally on seals. He is torpid in the snow during the winter. Each species is very sensitive and sagacious, and the unfortunate captive, the black bear, is made to perform feats for the diversion of *civilized* children. The young follow the dam for a year, and there are numerous anecdotes of their interesting attachment, when assailed by the greatest savages, and most remorseless of all savage animals.

There are four classes of apes or simia, called apes, baboons, monkeys and japajocs, in 63 species. The ourang-outang walks erect, and is often six feet high and very powerful, capable of imitating all the habits of man. The Barbary ape is known for his agility as an object of exhibi-

tion. The great baboon and dog-faced baboon are nearly 4 feet, and the preacher monkey, from a tree harangues, or howls, at monkey auditors. They all live on fruits and vegetables, and are harmless unless attacked.

It is a peculiarity of wolves, that they avoid passing under any thing, therefore shun woods, and seldom pass through hedges.

When wolves cross a river, they follow one another directly in a line, the second holding the tail of the first in its mouth; the third that of the second, and so of the rest. This figure was chosen by the Greeks to denote the year, composed of twelve months following one another, which they denominated Lycabas, that is the march of the wolves.

Abbe Pluche.

The full grown kangaroo weighs 150 pounds, and from the nose to the rump is 4 or 5 feet long, with a tail 3 feet. It uses its short fore feet as hands, like squirrels, and leaps on its hind legs 14 or 16 feet at a bound, faster than a dog can run. The female has a pouch for its young, and no creature can be more harmless.

The kangaroo displays a maternal feeling interesting to the moral sense. They are provided with an external pouch or bag into which the young retire in case of an alarm, and if the mother is wounded, she assists her offspring in its escape; on regaining a place of safety, she caresses it to dissipate its alarm, and if mortally wounded by any black or white savage, her attention is entirely directed to the security of her young.

Bull fights in Spain are equivalent to the fights of gladiators among the Romans, which at once disgraced and brutalized that people. The amphitheatre for this atrocious amusement, as it is called, is 330 feet in diameter, with an area of 225 feet, and sitting and standing room for fifteen thousand spectators. The assailants are called picadores, are on horseback, and provided with a long spear. The bull soon destroys the horse in the most horrid manner, and then other combatants on foot come in who carry cloaks to distract the bull till the picadore has procured a fresh horse, when the combat is renewed.

When a cow of the black cattle breed has two calves, one a bull and the other not, this other never breeds, and is of different character in size and habits, and known among farmers as a free martin, having the bellow of an ox, and no sexual propensities. Earth worms, &c. are of both sexes; and caterpillars and larva generally are of no sex till they change. All plants are hermaphrodite, except monœcia and diœcia. Mules and other mixtures do not propagate, and some cause of the same kind affects branches of the human family as stops to population; and hence the continual extinction of families; the male particularly being without offspring, as impotent or withered branches. Swammerdam traces this defect to luxury, and asserts that it arises oftener in royal and noble races than in others, their branches becoming continually barren or withered; and our extinct peerages and changes of royal lines justify his observation. We have no family of rank above 4 or 500 years old, while among yeomanry, successions may often be traced for 10 or 1200 years.

Mules are more hardy and longer lived than horses, bear heavier burdens, and are more sure footed. They are the product of a horse and she-ass, of an ass or mare, but do not propagate.

The lion has often been seen to despise contemptible enemies, and to pardon their insults, when it was in his power to punish them. He has been seen to spare the lives of such as were thrown to be devoured by him, to live peaceably with them, to afford them a part of his subsistence, and sometimes to want food himself rather than deprive them of that life which his generosity had spared.

Goldsmith.

Beavers are among the most sagacious of animals, and being gregarious, they claim sympathy by their social habits from every man who is a MAN. With their small paws and tails, they construct curious habitations, solid and strong. They choose a river, and form a dam across it with perfect foresight as to water way, strength, &c. contriving to drive strong stakes three feet into the bed of the river. They live chiefly on

roots, of which they form magazines for the winter, and sufficient for their village of 18 or 20 tenements. European merchants seduce the savage Indians, for rum and tobacco, to hunt and slaughter these harmless creatures for hats, though there are better materials; and for the castor, articles of trifling value compared with the outrage on humanity.

The wild boar is the parent of the common hog, but smaller, less gluttonous, and living chiefly on vegetables. They are only dangerous when attacked, and then the means of defence are tusks ten inches long.

The camel in the east, is the most valuable servant of man. It eats little and drinks less; the milk makes cheese and butter; shoes and harness are made of his skin; and of his hair tents and clothing; while for burden, he is the ship of the desert, and his power exceeds that of the horse in travelling.

Camels are from 6 to 7 feet high to the top of the protuberance on the back, and they weigh from 3 to 4 cwt. The Bactrian camel is the largest, and has two bunches on its back. The dromedary of the Arabians has but one, and is the most common. The bunch on the back is glandular, and not connected with the spine. They move both the feet on the same side, and therefore jolt their riders. They require little and coarse food, and live for 10 or 15 days without water. They kneel to take up their load, and carry from 500 to 1500 lbs. They have cavities in the stomach which retain water, or as some suppose, a second stomach. Their average pace is 2½ miles an hour. The deserts could not be traversed without them. Dromedaries are swifter than Bactrian camels, and without a load go 6 or 8 miles an hour for 10 or 12 hours. Caravans consist of from 1 to 4000, and many Arabs possess 4 or 500. The Tartars employ them in wagons: they cast their hair every year, and it is made into cloths, stockings, shawls, carpets, &c. Their useful lives extend from 40 to 50 years.

It is computed that, in an ordinary way, a dromedary will perform a journey of 500 miles in four days.

Dr. Gall relates an anecdote of a dog which was taken from Vienna to England, escaped to Dover, got on board a vessel, landed at Calais, and after accompanying a gentleman to Mentz, returned to Vienna.

The hedge-hog, is an inoffensive animal, often barbarously treated by the vulgar: they live on roots and insects, in holes in banks, and roots of trees with a mossy bed. It is torpid in winter, and rolls itself in a prickly ball if in danger.

The badger is another perfectly harmless animal, and the object of brutal attacks by the lowest of the people. They are about two feet long, and live under ground, feeding on roots, frogs, and worms, and perfectly inoffensive; yet, to bait a badger with dogs is a disgraceful sport of the vulgar in most parts of England.

The hare is a timid, but very sensible animal; it cries like a child when caught in a snare, and exclaims *rafe* with human distinctness when worried by ferocious dogs and hunters. It lives 7 years, and is often tamed.

That harmless South American animal, the Armadillo, when in danger, rolls itself into a ball and very hard.

When a porcupine is irritated, he erects his quills, but does not dart or shoot them.

The Java squirrel flies from tree to tree, by a membrane stretched like a sail. They are 18 inches long.

Sheep in wild pastures, practise self-defence, by an array in which rams stand foremost in concert, with ewes and lambs in the centre of a hollow square.

Mice will live entirely without water; for though, says Dr. Priestley, I have kept them for three or four months, and have offered them water several times, they would never taste it; and yet they continued in perfect health.

Black rats are tamed in Germany, and a bell being put about their necks they drive away other rats. The economick rat of Siberia lays in a stock of winter provisions. The hamster does the same, and to assist him has pouches on each side the mouth.

The behemoth of the Jews was either the hippopotamus or mam-

moth, said in the Talmud to feed on a thousand mountains in a day; a speed which accords with the Indian tradition about them, and with that of the great and terrible dun cow of Dunchurch.

The sheep in the Shetland Islands are calculated at 150,000, and the finest of their wool is wrought into stockings at two guineas a pair; the coarsest very cheap.

The Angora cat has one eye blue and the other yellow.

Wild asses in Tartary and Thibet live in troops, and keep sentry; being very vigilant, and if attacked, swift in escape.

Hogs and dogs were the only animals in the newly discovered South Sea Islands. The West India Islands contained only a small animal, the agouti. The continent of America contained many large animals, but unlike those on the old; and New Holland, &c. &c. only contained kangaroos and opossums, unlike others any where else.

Bullocks perform indifferently with yokes and bows: in France, they draw by the horns. They plough an acre per day with ease. Four bullocks draw three tons of coals; two draw 35 cwt. three miles; and two draw 1020 sheaves, weighing 6375 lb.
Young's Tour, II.

The horn of the rhinoceros alone is erect and perpendicular to the bone, on which it stands at right angles, thereby possessing greater purchase or power as a lever, than any horn could possibly have in any other position.—*Bruce.*

English race horses run at the rate of from 55 to 58 miles an hour, or a single mile in 62 or 63 seconds. Stage coaches, with their draught, often run 11 or 12 miles an hour. In a passion for swift travelling, George III. always went on journeys 14 or 15 miles; and his son, the Duke of York, used to urge post-horses 16. Bakewell's black draft horses will draw above three tons. A horse has 24 grinders, 4 tushes, or single teeth, and 12 front teeth. At five the colts' teeth are shed and the tushes appear; at six they are grown, and at eight the black marks disappear, and the horse is then called aged.

The pouch of the kangaroo and the opossum is a fold in integuments of the belly, with an external opening, where the young are received in a tender state, and nourished by the paps within the cover.

In New Holland, the quadruped which most prevailed at its settlement in 1787 was the kangaroo, with very long hind legs and with short fore ones, with a sack or bag under the belly of the female for the comfort and protection of the young. Of these animals and opossums there were 50 distinct species; they are very delicate and very intelligent animals. Another native animal is a quadruped with the bill of a duck, called the *ornithorincus paradoxus;* the birds are equally original. The swans are black, and the eagles are white, some of them 7 feet high: every thing had an original character. All the quadrupeds are like opossums, all the fish are like sharks, and the very land, the trees, and vegetable products, resemble one another in peculiarity. Many thousand species of plants have been discovered, mostly new. Of the gum tree there are 100 different species, some of them 150 feet high and 40 feet round. There are also 100 species of the leafless *acacia*, and these two kinds of trees compose the woods of the country. Van Dieman's land lies between lat. 41 and 43½ south, and is 160 miles long, and 140 broad. The climate is milder than that of England; but in the winter, from May to July, the mountains are covered with snow. The Eucalyptus or gum tree grows to 180 feet high and 36 feet round.

The *pip*, a disease of poultry, is a thin film which grows under the tip of the tongue.

The European wild cat is not considered as the original of the domestic cat, but a Nubian which passed through Egypt into Europe.

One pair of pigs will increase in six years to 119169, taking the increase at fourteen times per annum. A pair of sheep in the same time would be but 64.—*Allnut.*

The Aranea avicularia is a spider, large enough to catch and kill small birds.

Wolves were destroyed in England between 961 and 964.

Herrings breed in the Aretick Ocean, and in April and May pass in immense shoals through the British Seas, followed by fishes and birds of prey. The Dogger Bank in the North Sea, 190 miles long, is the favourite resort of these and of turbot, cod, soles, &c. Other banks in the same sea, from Holland to the Shetland Islands, are also resorts of fish.

In the Bahamas the violet crab lives in the mountains, but spawns in the sea, and travels there for the purpose; after which the young crabs travel to the mountains.

Cock-chafers, so cruelly abused by untaught children, are such pets of nature, that they are six years in the grub state advancing to maturity.

Eggs are hatched at 104° of heat.

Hives yield from 60 to 100 lbs. of honey in a season.

At Coppermine River fish were so frozen as to break with the blow of a hatchet; but if others were thawed before the fire, they revived.

Spiders have four paps for spinning their threads, each pap having 1000 holes; and the fine web is itself the union of 4000 threads. No spider spins more than four webs, and when the fourth has been destroyed, they seize on the webs of others.

Perfectly white cats are deaf.

Young eels migrate from salt water to fresh through every obstruction.

The water beetle which lives on the spawn of fish, is said to convey it from one pond to another.

In Upper Canada travellers go in cars drawn by three dogs.

A fish in Java called the jaculator, catches flies and insects by squirting from its mouth some water, and seldom misses its aim at the distance of five or six feet, bringing down a fly with a single drop.—*Mitchel.*

Earthworms are said to restore themselves after being cut with a spade. A snail's head and horns grow again in six months. An eye of a water newt is replaced in ten months.

The liquor of the oyster contains innumerable embryos, with transparent shells—120 to the inch; and also other animalculæ, as three kinds of worms, &c. They turn over with the tide. The sea-star, men, cockles, and muscles are their enemies.

Marmots cut, make, and carry hay for their nests.

Swallows stay in England from 22 to 26 weeks.

Other birds from the aretick circle pass their winter with us and breed there, as the auk, the woodcock, snow-bunting, &c. which pass to Lapland, Greenland, &c. Some migrate by night and others by day, and the males go before the females as is well known to bird catchers. Some of them are supposed to travel at the rate of 150 miles an hour, and most of them start when the wind is fair. At this rate, swallows, &c. would reach the African coast in a day, and the German ocean would be crossed in a morning. The accidents of the journey and of the country thin their numbers, for fewer return than go; as population has increased some do not return at all, as egrets, cranes, &c. of which, anciently, there were many in England.

M. Hanbert saw a regular battle between two species of ants, in which they drew up in lines of battle, with reserves, &c. &c. and fought for four hours, taking prisoners, and removing the wounded till victory decided for one party.

The poor seals have found advocates in the phrenologists, the size of their brains indicating extraordinary intelligence, and their docility being interesting.

In Livonia holes are bored in old trees to receive swarms of bees, and with great success.

A hog killed at Newmarket, in December 1829, weighed 940 lbs. or 117 stone, or 67 stone 4 lb. horseman's weight.

Mr. Audubon describes the wonderful flocks of Pigeons which range over North America. He saw 163 in 21 minutes, all passing in one direction, at the rate of a mile per minute, and he estimated each flock as containing a billion of pigeons, and in this way, they were passing for three days.

A toad was found at Organ in France, in a well, which had been covered up for 150 years. It was torpid, but revived on being exposed.

When bees leave a hive, all the individuals first reconnoitre the new situation in small parties.

Reptiles become torpid when the temperature is below 40°. Snails, mollusca, and land testacea do the same. In hot and equal climates, as between the tropics, instances of hybernation are unknown.

The sleep of winter and that of night are different in those animals which are torpid for months. The bat, the hedge-hog, the tawrie, the marmot, the hamster, the tortoise, the toad, snakes, mollusca, spiders, bees, flies, bears, badgers, &c. retire to their closed holes, and, in various degrees, undergo a temporary death for four, five, six, and seven months of the year. They usually roll themselves up, but bats suspend themselves in caves. Those who lay up provisions use them before they become torpid, and on reviving before they venture abroad. Their temperature lowers; their respiration is less frequent and at intervals, the circulation is reduced; they lose their feeling, the digestive organs are inactive, and they suffer loss of weight. The confined air in which they shut themselves, added to the cold, is a cause of their torpidity. Facts lead to the belief that some birds hybernate.

Two raindeer drag a sledge 50 or 60 miles a day. The traveller is tied in it, and poises it as necessary.

Fallow deer fight in parties for their pasture, often for successive days. The males for the females till one is master.

In mountain flocks of sheep, a ram or wedder takes the lead, and will kill a dog or resist a bull; and at times the whole draw up in battle array, and fight without retreat.

One-eighth of the sheep in Great Britain perish every year of various diseases. There are supposed to be thirty millions.

Herds of cattle, when attacked by a wolf, place the calves in the centre of a circle, and resist in form; or the bull advances and drives away the enemy.

The horns of the Abyssinian ox are nearly four feet long, and seven inches diameter at their base.

The Abyssinian buffalo is double the size of our oxen; and two draw as much as four horses there, in Egypt, and Persia.

Childers ran four miles in 6 minutes, 48 seconds, or at the rate of 35⅓ miles an hour, carrying 9 stone 2 lbs.

A horse frequently sleeps while standing.

Spanish asses are often 15 hands high.

The mule is the produce of the *male* ass and mare, and the *hinny* of the she ass and horse. The mule is larger, more like the mare, and the hinny more like the she ass. Neither propagate with one another.

The ursine seals live in communities, every male having ten or twelve females, protecting his own family, and preserving social intercourse, with great interest and sagacity.

The dam of the northern foxes will follow those who kill her young for 60 or 70 miles, and howl round them by night and day, till she has in some way avenged herself.

The dog, the fox, wolf, and jackal intermingle their breeds. Jackals hunt in packs with much noise, and hence drive prey into the haunts of lions, &c.

Marmots make spacious and convenient habitations of several chambers, some of them several feet in diameter.

The spines of the porcupine are from nine to fifteen inches, and perfect hard quills, which the animal can raise at pleasure, but not dart as pretended. They roam by night in quest of roots and vegetables, and are inoffensive, their spines protecting them from all attacks.

The sloth crawls on its belly, and does not advance above 100 yards in a day. It is two days in climbing and descending a tree.

The hippopotamus lives and walks in water for security, occasionally thrusting up its nostrils or head. In the night it feeds on sugar-canes, rice, maize, corn, &c. They weigh

2½ tons; but are inoffensive unless attacked, or in the pairing season.

Dromedaries have been tried in the West Indies, but without success.

The herds of lamas, and those of most animals, have sentinels to give warning of the approach of danger.

Male deer only have horns, which, after their sixth year, they shed annually; they weigh from twenty to twenty-five pounds. The park deer are called fallow deer. The great red deer are less common. They have a leader, and, if necessary, fight in concert. The females expose themselves to save their young.

Size of Mammalia.

Man—4 to 5 feet in Lapland and Labrador; 5½ to 6½ feet in Europe and Asia; 5 to 5¾ in Africa and America; and 6 to 8 feet in Patagonia.

Ourang Outang	4½ to 5½ feet
Pigmy apes	2 feet
Four-fingered	1½—tail 2 feet
Striated monkey	5 inches
Vaulting monkey	13 inches
Malbrook	1½ feet
The Barbary ape	3½ feet
The sphynx	3 or 4 feet
Dog-faced baboon	5 feet
The preacher	3½ feet
The lemur	1 foot
Vampire	6 to 12 inches
Common bat	4 or 5 inches
Spectrum bat	7 inches
Hedgehog	10 inches
The Shrew	2½ inches
Mole	6 inches
Badger	2½ feet
Glutton	2½ feet
Ratel	2 feet
Racoon	2 feet
Ichneumon	15 inches
Weasel	7½ inches
Ferret	14 inches
Martin	18 inches
Ermine	10 inches
Sable	11 inches
Polecat	17 inches
Zurillo	17 inches
Otter	3¼ feet
Lion	6 to 8 and 9 feet
Lioness	5 to 6 and 7 feet
	Tails 3 feet, height 3 to 5
Tiger	8 to 9 feet
	Tail 4 feet, height 4 feet
Wild cats	2 to 5 feet
Lynx	4 feet
Civet	2 feet
Hyena	3 feet
Fennec	10 inches
Wolf	2½ to 3 feet
Fox	1½ to 2 feet
Jackal	2½ feet
Opossum	15 to 18 inches
Wombat	2 feet
Kangaroo	3 to 4 feet
Flying squirrel	6 inches
Ordinary squirrel	8 inches
Jerboa	7 to 8 inches
Dormouse	6 inches
Marmot	10 inches
The porcupine	2½ feet
The ant-eater	12 inches
	Spines 4 feet
Great ant-eater	4 feet
The pangolin	6 or 8 feet
The armadillo and tail	5 feet
The elephant	10 or 11 feet
	8 to 10 feet high
The tapir	6 feet
The rhinoceros	12 feet
	6 or 7 feet high
The hippopotamus	12 to 20 feet
The dromedary	6 or 7 feet
	9 feet high to top of head
The Lama	6 feet
The musk deer	3¼ feet
The stag	4 to 5 feet
Roebuck	3¾ feet
Raindeer	4 to 5 feet
Giraffe	15 or 16 feet high
The chamois	3 feet
The antelope	3¼ feet
The pigmy antelope	10 inches
The bottle-nosed seal	11 to 18 feet
Ursine seal	6 to 9 feet
The maned seal	10 to 14 feet
The common seal	4 to 6 feet
The walrus or morse	15 to 18 feet
Manati	20 to 28 feet
The Siren	5 feet

Mamiferous animals are divided into ungueulated with nails, unguculated with hoofs, and nectopode or Web-footed. The first order is man, or homo—the first family of the second order is the simia or monkey tribe, in 9 genera, and many species. These live in colonies, and distinct species in the same forest without mutual annoyance, and in the same trees with parrots. They mimick man in every thing. The ourang-outang has no tail, and full grown, are 5 or 6 feet high. Their arms are long, and they use them as legs and hands. They carry clubs for offence, move in herds, and reside in huts made of leaves. Two or three which have been brought to Europe were

docile, sensible, imitative, and very affectionate. In Africa they perform much labour, and are very useful. The pigmy without a tail is but 2 feet high, but very ingenious, active, and mischievous. The mona monkey is a great favourite in India, and they are fed and encouraged in some places. At Amanadab the Gentoos have three hospitals for them, and at Dherboy they are more numerous than men, and must be fed or do mischief.

It is the magot or Barbary ape which is usually made to perform feats in Europe. The sphinx-baboon is 3 or 4 feet high. In Borneo they pillage houses, and move in large and very mischievous troops. The ursine baboon resides in the high lands, near the Cape of Good Hope, and is very mischievous, and often dangerous to single travellers, carrying clubs and throwing stones with great dexterity. The preacher monkey or Beelzebub, fills the woods with noise, travelling on the tops of the trees, and one haranguing the rest, displaying in every thing perfect sagacity.

The lemur family in 5 genera, are like the monkey, except in the head, which more resembles the fox, and they are less imitative, though in trees as active as monkeys.

Bats have two pectoral teats and the thumb separated from the fingers. They fly, but they have neither feathers nor beak, they are covered with hair and have teeth. They breed living young and suckle with teats. Their wings are the drapery of their bodies except when they stretch it to fly. They fly in the dark, and avoid objects not by seeing, but by some sense.

The Hamster rat is of the largest species, very bold, fierce, and destructive. They construct very curious dwellings and are dormant in winter, but store up provisions. They are without fear and fight till overcome; and so numerous as to create scarcities of grain. The meadow mouse has similar habits, but it is timid, though destructive of corn crops.

The Lemming varies in size from the rat to the mouse, and is celebrated for its numbers, and their straight line of emigration in tens of thousands, never turning aside, and destroying as they advance, but encamping at times, and acting with method.

Mice are easily tamed and are very amusing, being fond of music, and very clean, elegant, and harmless. They shun the odour of elder.

Brown rats were unknown in England till 1730, but they now exceed native black rats in numbers. Their numbers drove the Dutch from the isle of France. They are often tamed and have been taught to play tricks.

Guinea pigs or cavies are the most prolific of animals, but very harmless and amusing, also very clean, feeding on herbs, parsley, &c.

Hares are universal animals, but of various sizes, from 7 to 12 lbs. In the arctick circle they are white in winter. Their stratagems to escape danger are numerous and ingenious, but besides man, the enemy of every thing living; they are the prey of dogs, cats, weasles, eagles, &c.

Rabbits do not burrow in hot climates. They have sentinels to give warning of danger, chiefly females, who enter the holes last. The Tartarian hare is not larger than a rat, and lives in deep burrows.

The great ant-eater catches ants by stretching out its tongue and lying still, and on the ants rising on it he draws in his tongue. But it often breaks into the hills and penetrates them with his tongue till satisfied. They have been tamed.

Mole-hills are curiously formed by an outer arch impervious to rain, and an internal platform with drains, and covered ways on which the pair and their young reside. They live on worms and roots, and bury themselves in any soil in a few minutes.

Badgers form houses like moles, under ground, and in rocks, and though a large animal 2 or 3 feet long, it is perfectly inoffensive, and easily domesticated. The glutton is the size of the badger, and very fierce and voracious, eating from 6 to 13 lbs. of flesh per day. The racoon, of the same genus, is well known in Jamaica, &c. where in troops, it devours the maize and fruits, and displays great ingenuity

in catching shell fish. The ichneumon, in Egypt, performs the office of the European cat as a destroyer of rats and reptiles, and devourer of eggs. It is like the cat, but legs shorter. The weasel has similar propensities in northern climates. The ferret is the length of a cat with the habits of the weasel. The martin is an enemy of cats. The ermine or stoat, and the sable are like weasels, but longer, and their skins fetch high prices. The pole-cat is larger than the male house cat, and very destructive to poultry, pigeons, rabbits, &c. The genus mephitus, has glands near the anus, which secrets a fetid acrid liquor which they squirt on their enemies with unerring destruction to clothes and skin, and so offensive as to be distinguished for a mile or two around.

Animals which live on vegetables have no gall bladder. It is the same with the pigeon, parrot, and ostrich, and with mollusca.

In some *ruminantia* the intestinal canal is 27 times the length of the animal, and in *rodentia* 15 times: in hogs 13 times: in the horse the colon is 24 feet, but in the dog only 6 or 8 inches. In the turtle the intestinal canal is 5 times the length of the body.

The hoofs of animals are similar to the nails of man, and grow from the roots. Hair and feathers are analogous to the human hair.

Horns of animals are similar, in general, to nails and hoofs; in cows, sheep, &c. they are formed of concentrick layers in fibres, like a collection of hairs agglutinated together. In deer they are bones attached, but in the giraffe part of the skull.

The guinea pig has 10 teats, the rat 12, and the hare 10. In a laying hen, the ovary contains a great number of yellow round bodies, each in its own membrane or calyx, which when exuded is received into an extension of the membrane, forming a bunch, of which the outer are the largest. These are the yolks of future eggs, to be provided with whites and shells.

The procreative powers of animals are so various that Linnæus had a design to extend his sexual system to them. Leeches and earth-worms are hermaphrodite, as well as snails and slugs.

The brain of fish is small and does not fill the skull. They have no tympanum, and no external ear. They have neither windpipe nor larynx, but breathe by gills. Their nose is not connected with respiration, and they have no urinary bladder.

In the ovula of carp fish, called the roe, nearly 150000 germs of eggs have been counted, and in that of the sturgeon, weighing 160 pounds, nearly 1500000.

The antennæ, or double, or quadruple horns of insects are so curiously shaped that 160 different forms have been noted. They are an organ of power and discrimination, like the arms of a man, or the trunk of an elephant, and have been supposed to be the residence of a peculiar or sixth sense.

The bones of birds are hollow, and filled with air instead of marrow.

Crustacea have teeth within the stomach.

In serpents and fish both jaws are moveable.

In animals that have no circulating system, the air is respired by air tubes running below the skin, called tracheæ, as in insects and mollusca; or it passes through the integuments to every part of the body, as in worms and zoophytes.

The lungs of birds are small, and of a flattened form, and much dispersed; but they respire through the bones and in cavities of the muscles.

All hair is hollow and cylindrical. Young birds are covered with it, and feathers are a variety proceed from a bulbous root in the skin.

In the larva of insects there is an air tube on each side, with branches and several apertures.

The neighing of a horse is effected by a membrane which is attached to a cartilage, and runs along the margins of the glottis. The braying of an ass is produced by a similar membrane, and two large sacs which open into the larynx. It is the same with the mule. In apes, the bone connected is concave, and hence their noises.

The liquid poison of vipers and other animals is of a yellow colour. It is secreted in two small vessels, and communicates by a tube with the crooked fangs of the viper. It has no taste, but applied to the tongue produces numbness. A brownish yellow substance, like gum arabick, remains after evaporation. Taken into the stomach it kills small animals immediately. The poison of the bee is similar in appearance. It does not yield to the ordinary tests of analysis.

The gills of fishes are composed of four plates on each side, and communicating with the throat by a single opening for each gill. They receive the water by these holes, and discharge it by a different opening, after appropriating the air. The gills too have a moveable cover.

The gills of the cancer are near the legs; and in snails there is a cavity in the neck, which can be opened by the animal at pleasure, and which communicates with pulmonary vessels.

The *rete mucosum*, the coloured layer which lies between the cuticle and the skin, is one-sixteenth of an inch thick in whales, and is of the consistence of the grease rubbed between the nave and the axle of wheels. The rete mucosum gives colour to all animals, and Cuvier considers shelly coverings as analogous to it.

In many animals torpid in the winter, the fat in the cellular membrane is absorbed as nourishment. In some, as whales, hogs, seals, &c. it is nearly fluid. In some, the integuments have muscles; as laughing in man, the power of coiling in the hedgehog, of moving feathers in peacocks, turkeys, &c.

Hairs are a sort of vegetation on animals. Their trunks are round, triangular, or square. It may be bleached on grass, like flax, and dyed of any colour. It is made to curl by boiling and baking. 1152 grains yield 90 of carbonate of ammonia, 179 water, 288 gas, and 324 coal. It contains silex, sulphur, oil, iron, manganese, and lime. It measures in man, the forty-eighth of an inch.

The ossification of soft parts of bodies arises from the deposit of phosphate and carbonate of lime on the part.

Horn is distinguished from bone by its bending, and softening by heat and water. They consist of albumen, some gelatine and phosphate of lime.

Ambergris is an internal production of deceased spermaceti whales.

Spermaceti is produced from the head of the cachelot, and ambergris is the excrement of its intestines.

The Bezoar stone sought as a charm for the cure of many diseases. is produced in the stomach of goats, antelopes, and sometimes camels. Its nucleus appears to be some indigestible hard seed or stone, and its specific gravity is from $1\frac{3}{4}$ to $2\frac{1}{4}$.

Fish and birds can see through the nictitating membrane, which they draw over their eyes to screen them from the sun.

The peculiar secretions of animals are as under :—

Castor, near the end of the rectum in the beaver.

Civet, in the same part of the civet cat.

Musk, near the navel of the male musk.

Fœtid emanations in many when attacked.

In whales, *spermaceti* and *ambergris*.

Oil, by birds, to lubricate their feathers, taken from the rump.

Poison, by serpents.

Silk, by the larvæ of the silkworm; and the webs of spiders.

The *acrid matter* that passes through the stings of wasps and bees.

The *inky fluid* of the cuttle-fish, in a bag near the anus.

Silky matter produced by the sea muscle, &c.

Leach divides insects in 15 orders:

SUBCLASS I. AMETABOLIA.

Insects undergoing no metamorphoses.

ORDER I. *Thysanura*. Tail armed with setæ.

Order II. *Anoplura.* Tail without setæ.

Subclass II. METABOLIA.

Insects undergoing metamorphoses.

Century I. *Elythroptera.* Insects with elytra.

Cohors I. *Odontostoma.* Mouth with mandibles.

Metamorphoses incomplete.

Order III. *Coleoptera.* Wings transversely folded; elytra crustaceous, covering the wings, with the suture straight.

Metamorphoses nearly coaretate.

Order IV. *Strepsiptera.* Wings longitudinally folded; elytra coriaceous, not covering the wings.

Metamorphoses semi-complete.

Order V. *Dermaptera.* Wings longitudinally and transversely folded; elytra somewhat crustaceous, abbreviated, with the suture straight.

Order VI. *Orthoptera.* Wings longitudinally folded; the internal margin of one elytron covering the same part of the other; elytra coriaceous.

Order VII. *Dictuoptera.* Wings longitudinally folded twice or more; elytra coriaceous, nervous, one decussating the other obliquely.

Cohors II. *Siphonostoma.* Mouth with an articulated rostrum.

Order VIII. *Hemiptera.* Elytra somewhat crustaceous, or coriaceous; towards the apex generally membranaceous, horizontal, one decussating the other obliquely. Metamorphoses half complete.

Order IX. *Omoptera.* Elytra entirely coriaceous, or membranaceous, and meeting obliquely, with a straight suture. Metamorphoses semi-complete, or incomplete.

Century II. *Medamoptera.* Insects without wings or elytra.

Order X. *Aptera.* Mouth with a tubular sucking rostrum. Metamorphoses incomplete.

Century III. *Gymnoptera.* Insects with wings, but no elytra.

Cohors I. *Glossostoma.* Mouth with a spiral tongue.

Order XI. *Lepidoptera.* Wings four, membranaceous, with peterigostea, covered with meal-like scales.

Cohors II. *Gnathostoma.* Mouth with maxillæ and lip.

Order XII. *Trichoptera.* Wings four, membranaceous, with peterigostea, and hairy.

Cohors III. *Odontostoma.* Mouth with mandibles, maxillæ, and lip.

Order XIII. *Neuroptera.* Four highly reticulated wings, generally equal in size; anus of the female without a sting, or compound borer.

Order XIV. *Hymenoptera.* Four venose wings, hinder ones smallest; anus of the female with a sting, or with a compound borer or oviduct.

Cohors IV. *Siphonostoma.* Mouth tubular, formed for sucking.

Order XV. *Diptera.* Wings, and halteres or balancers two.

Few insects live more than a year in their perfect state, but often much longer in their larva state. Their first state is the egg, then the caterpillar, then the chrysalis, or pupa, and finally the perfect and procreative form. But in these changes there are infinite degrees and varieties of transition, all which constitute the pleasing and very instructive study of entomology.

Insects appear as eggs hatched in a caterpillar or larva, which changes into a motionless chrysalis or nympha, the covering of which bursting, a butterfly, evolves with wings, long jointed legs, and two antennæ. Some have jaws, others no jaws; some have no wings, and others have four wings variously marked, and one order but two wings.

Insects have lymph instead of blood, and no bones, but hard coverings to which the muscles are attached. They have no vertebra. They do not breathe through the mouth or nostrils, but have air vessels along their sides, called *spiracula*, and connected with other vessels called *bronchiæ*. They have the organs of sense, and make all the discriminations which accord with their physical powers and wants. They are oviparous, but scorpions and aphides are viviparous. All the winged insects exist as larvæ, and undergo metamorphoses previous to their perfect or propagating state. The male is always smaller and more coloured

than the female, which alone have stings, but males have horns.

Insects breathe through holes or pores on each side of every segment of the abdomen, called *spiracula*.

The antennæ are important organs of insects, equal to the hands of man. By them the bee works in constant darkness.

There are 292 species of the bee or apis genus, and 111 in England: among solitary bees the following deserves notice:

The *rose-cutter* separates circular pieces from leaves with precision, and digging a hole 6 or 8 inches deep in the ground, the bee rolls up the leaf and depositing it in the hole, lodges and secures an egg in it with food for larvæ when hatched, and often several, but all separated, and very perfect; and the bee then resides in the upper part to protect her brood.

The *upholsterer* makes a hole enlarged at the bottom, and lines the whole with red poppy leaves, lays her eggs, supplies them with food, &c. separately, then turns down the lining to cover them, and closing the hole leaves them to mature.

The *wood-piercer* makes a perpendicular hole with vast labour in a decaying tree in the sun-shine, a foot deep. Then deposits her eggs and food, and separates each by a dwarf wall made of saw-dust and gluten, each higher than the other, and the last closing the hole; and she then makes another hole horizontally, to enable them to escape as they successively mature.

The *mason-bee* constructs a nest on the side of a sunny wall—makes up sand pellets with gluten, and by persevering industry fixes and finishes a cell in which it lays an egg and provisions. It then forms others beside it and covers in the whole, the structure being as firm as the stone.

Wasps and *humble-bees* make cavities in banks. They line them with wax, and make innumerable cells for their eggs in perfect communities, working together and forming lines in the removal of whatever incommodes them.

The *honey-bee* is well known and deservedly respected for the use which man makes of their industry; and too often by the wholesale *murder* of the ingenious creatures whom he robs. But this most cruel practice is now even from selfish motives abated. The queen is the mother of the whole hive, and her eggs become males, females and workers or neuters, which last make the combs and cells, and collect the honey. The queen produces some thousands of workers, and then males, which the workers kill at the end of the summer. The workers attend the queen with anxious respect. If she die, they raise a new one by various arts from a working worm. Two queens cannot live in the same hive, and one is destroyed.

They have four wings and six legs. The body is covered with hair and each hair is like a plant in miniature. The proboscis is employed in collecting honey by licking it from the flower and conveying it to the stomach, whence it is disgorged into the cells. The wax is formed from the honey. The females and workers have a sting, but the males or drones none. It is double and provided with barbs, which the animal depresses and draws out the sting unless suddenly driven away. The sting emits a poison into the wound.

In proportionate size the queen bee is $8\frac{1}{2}$, the male 7, and the workers 6. A queen will lay 200 eggs daily for 50 or 60 days, and the eggs are hatched in three days. The workers are 5 days in the worm state, and in 20 days they become bees. The males are 6 or 7 days in the worm state, and 24 days in becoming perfect bees. A queen is 5 days in the worm state, and in 16 days is perfect. When eggs are converted into queens the old queen destroys them, or if there are two young queens they fight till one has killed the other. One author asserts that a single queen has produced 100000 bees in a season. Every thing depends on the workers; they collect the honey, make wax, and build the combs, they supply the worms with food, and protect the entrance of the hive; separate business being performed by classes.

There are about 9000 cells in a comb of a foot square; their first purpose is as nurseries for the young,

and they are then cleaned and filled with honey. 5000 bees weigh a pound. 20 or 30 pounds of honey are generally got from a hive, sometimes 80 or 100 lbs., and even more. Formerly it was an inhuman practice to suffocate and destroy the bees, thereby uniting murder with robbery; but good managers have, for many years past preserved them and fed them during the winter, by which plan, five hives at 1*l.* each, have in ten years yielded a profit of 1280*l.* To destroy the swarm for the sake of the honey, is like cutting down fruit trees for the sake of the fruit, independent of the atrocious cruelty attending the practice.

A swarm of bees contains from 10000 to 20000 in a natural state, and from 30 to 40000 in a hive.

All the experiments on bees prove, that love for their queen and her progeny is the sole stimulus to their persevering industry. Their joy, grief, and other passions are distinguished in the tone of their humming, which to them are articulate sounds. It is the same with other insects, and with all animals, with various extents of vocabulary.

The hexagonal cells of bees have angles of 109° 26′ and 70° 32′, being the least matter and the largest size in the space.

The wasp's nest is equally wonderful with the bee-hive, and forms a regular city, fortified against encroachments, and containing 15 or 16000 cells for young.

There are 500 species of the parisaical flies called ichneumon. They deposit their eggs in other insects or animals, and there the larva are hatched and find nourishment.

A single female house-fly produces in one season 20080320!—*Haller.*

There are 72 species of aphis from a line long to the size of a fly. They are the blight of vegetation. They are hermaphrodites for the most part, and oviparous. Their excretions are honey, and they are the food of bees and other insects. But they puncture and curl leaves, and destroy wherever they harbour. Earwigs and birds also destroy them, and ichneumon flies make their bodies depositaries for their eggs.

Ephemera are a genus of short lived insects which live in their perfect state some 2 or 3 days, some a night, and some species not above an hour. As larva and chrysalis, they live for two or three years in water. But in their final form they propagate and die, the female in this short time laying some hundred eggs on water which sink to the bottom.

The louse lays 60 eggs in 6 days, which are hatched in other 6 days.

The itch is caused by a mite which lives in a vesicle of the skin. In other cases, the same genus obtains a habitation in the body, causing a disease called *morbus pedicularis.*

Of centipedes or Scolopendra there are 19 species, some very large with two legs for every division of the body, but seldom, if ever, 100.

There are 60 species of the dragon-fly, all very ravenous in regard to smaller insects.

The gad-fly deposits its eggs in the bodies of horses, cattle, sheep, &c.

The Peruvian fulgora or lantern-fly is above 3 inches long. The head or lantern is half its length and of a straw colour, and the light splendid. There is also a smaller species in India.

There are several hundred species of the scarabœus or beetle genus. The hercules species is 5 or 6 inches long and beautifully marked.

A thousand species have been enumerated of the genus musca or fly.

In Mexico and South America, fire flies are very common, which shine by so strong a phosphoric light, that a person may read by the light of three of them. The largest species have a luminous patch under the belly, and one on each side of the head. Another species has the light under its wings. When the fly is dead the light continues, and may be transferred.

There are no grounds for the terror inspired by ear-wigs. No medical case is recorded of mischief from them, and oil or brandy would instantly kill, or expel them; while they can in no case penetrate beyond the external orifice.

The speckled caterpillar, which produces the magpie moth, lives through the winter on currant and gooseberry trees.

Many spiders, moths, and beetles. counterfeit death when in danger, and no torture will make them show signs of life while the danger continues.

Gossamer consists of the fine threads of the flying spider, covered with dew.

The order *Parasita* includes the louse species, which are so numerous that every species of bird, and it is believed every animal, has its own particular kind; and the same species never was found on two distinct species of birds or animals.

The species of louse which runs on the bodies and garments of men is not the same as that which inhabits the head.

The *monas*, a water hydated or viscid bubble, is the first germ of animal secretion, or stomachick absorption.

Leuwenhoeck reckoned 17000 divisions in the cornea of a butterfly, each of which he thought a separate crystalline lens. Spiders, &c. are equally provided for.

The flea, grasshopper, and locust, jump two hundred times their own length, equal to a quarter of a mile for a man.

The insect which eats round holes in furniture is the DERMESTES *domesticus* and the species *lardarius* eats the leather off books and any animal substance.

The *termes fatale* or white ant, builds pyramidical structures 10 or 12 feet high, divided into a vast variety of apartments, and so strong as to permit four men to stand on them. The community is well governed, they appear in discipline to exceed all animals.

The ant-hills of our fields are full of cells and passages curiously formed with twigs and weeds cemented by their own gluten. They disfigure a field, and do not diminish but rather increase its productiveness for grazing; and in grazing districts they abound, and are seldom disturbed. They present a larger surface to the air and increase the quantity of grass and animal food, while they fertilize the soil.

The nests of ants are managed by the neuters, and usually established in mole hills, or among the roots of trees. There are eighteen species, and they are remarkably intelligent, ingenious, and industrious. Nests often fight like men, and kill vast numbers of each other.

An ant's nest consists of males and females, who have wings; and also of neuters. The females enjoy the same pre-eminence as among bees; but the manners of ants are more varied, and system, object, and end, mark all their varied reasonings and labours. They have long and tenacious memories, know each other, and distinguish any stranger. They carry on systematick wars, and practise all the arts of attack and defence. Man himself is not more savage in war: but they are citizen soldiers, and not hired and trained for butchery and murder. They also practise slavery, making slaves of those they overcome. They keep aphides, as men keep cows, for the juices which they yield. Their nests are formed at pleasure, and their cells of various forms. In Brazil they are almost masters of the country, and in Africa not less formidable. The termites white ants, or cutters, not only destroy furniture, clothes, &c. but raise conical buildings nine or ten feet high like villages, which it is inconvenient to approach.

There are 6 or 7 generations of gnats in a summer, and each lays 250 eggs.

Bees, beetles, dragon flies, gnats, spiders, &c. have been observed to have minute *acari* or mites on their bodies.

The gall fly forms the gall nuts on trees and plants by its eggs and young, and the gad-fly does the same in the skins of cattle.

There are 50 species of wood-peckers. The largest native of England is the green, 13 inches long, an enemy of ant-hills.

The black ostrich stands 7 feet high. Their speed is that of the horse, and they can carry a man. The cassowary is as large but has a shorter neck. Both of them are African, and they feed on vegetables.

In Norway, eagles destroy oxen by the following contrivance: they dive into the sea and then roll themselves in the sand and afterwards, by flapping their wings and shaking their

feathers into the eyes of an ox, they blind it and overcome it.

The American pelicans carry food to any other who is ill or disabled. And the pelican carbo or cormorant is used on the Chinese coast for fishing, and formerly was so used in England. Gannets abound in the western islands, and 20,000 are taken annually at St. Kilda.

There are 32 species of the falco genus, including most birds of prey, as eagles, kites, hawks, falcons, &c. They are very active, keen-sighted, strong, and long-lived. They live on young animals, fish, seals and other birds. It is a libel on human nature to state that these savage birds used formerly to be tamed and used for the genteel pastime of falconry.

There are 4 species of swallows, or hyrundo genus; the chimney swallow (*rustica*), the house martin (*urbica*), the sand martin (*riparia*), and the swift (*apus*), and they arrive in spring in this order.

The bird of Paradise is a native of North Guinea, near the Equator. They migrate to Aroo in flights, but will not live in the cruelty of confinement.

There are 50 species of owls, a bird of night, and very solemn in its appearance, having a ruff which resembles the full wigs now worn only by judges.

The birds which pass but part of the year in Britain, are the cuckoo, grouse, wryneck, stare, hoopoe, thrushes, ring-dove, chatterer, turtle-dove, grosbeaks, buntings, finches, larks, fly-catchers, wagtails, warblers, nightingales, black-caps, willow-wrens, white-ears, white throats, goat-suckers, herons, curlews, snipes, rails, wild-ducks, and other water fowl.

Carrier pigeons are a larger species than the common pigeon. They have a wattle extending over half the bill, and hanging down on both sides as a piece of white flesh, and this is supposed to be connected with the properties as a carrier. The eyes are also surrounded by a similar substance, and importance is attached to its width. Noah seems to have employed one, and they were used by the ancients during sieges. The Turks and all ea tern nations employ them, and in Turkey there are stations from which they pass and fresh birds are forwarded. The Turks train them to different distances progressively, and their flight is only certain while they have eggs or unfledged young. They rise very high before they start, and travel from 25 to 40 miles an hour. Besides this singular return of pigeons, the swallow, and the crow, and cats and dogs, have the same occult faculty.

Sparrows generally have 3 broods in a year.

The song of birds is a movement in succession, equal to a bar of 4 adagio crotchets, performed in 4 seconds.

Of singing birds, the nightingale unites the highest perfection of qualities, the linnet next, then the titlark, the sky-lark, and the wood-lark, the goldfinch and the robin excel in lively notes.

Birds have two larynxes at each extremity of the wind-pipe. That next the lungs is the organ of singing. In some there are windings in the windpipe. Frogs have in their larynx membraneous bags.

In July most singing birds become silent. Those which sing through the winter are chiefly young birds.

In the arrivals of migrating birds, the males arrive several days before the females.

Birds of passage which pass to very distant climes and regions, return to the same localities, and often occupy the same nests, though absent for many months. The swift departs before the 1st of September, chimney and house swallows early in October, and the sand-martin about the middle: the cuckoo in spring precedes the arrival of the sand-martin. The crake, the quail, and the goat-sucker pass the summer in our latitude, but the red-wing, the field fare, the woodcock, the snow-bunting, the silk-tail, the hoopoe, pass the winter with us: it is believed that the swallows, &c. which visit Europe in the summer, pass the winter in Africa, and the birds which pass the winter in this climate, pass the summer in Lapland, Norway, and Iceland.—Their migration can, of course, only be the result of intelligence and habit, in which the older birds direct the

young ones from generation to generation. Their flights to and fro are often witnessed in the Mediterranean, but the greatest curiosity of their economy is that of returning to the same localities. Some writers pretend that swallows do not migrate because they find a few at the bottom of ponds, which have been drowned in skimming them to catch flies.

The cuckoo begins to sing, and swallows appear in different parts of Great Britain between the 20th of April and the 10th of May.

Five species of birds of passage enter Spain annually from Africa, and are seen to pass and repass in flocks at certain changes of the season.

I have found by experience, that migrating birds go in a direct line from north to south, and never take their course from east to west, or west to east. *Hasselquist.*

The magpie, the wren, and the long-tailed titmouse, among British birds build domed nests.

The voluntary act of emptying the stomach is possessed by some birds, as the pigeon, who has an organ for secreting milk in its stomach, as Mr. Hunter observed: and it softens the food for its young by previously swallowing it; and afterwards putting its bill into theirs, returns it into their mouths. The pelicans use a throat bag, for the purpose of bringing the fish which they catch in the sea to the shore, and then eject them and eat them at their leisure. I am well informed of a bitch, who, having puppies in a stable at a distance from the house, swallowed the flesh meat which was given her, in large pieces, and going immediately to her whelps, brought it up out of her stomach, and laid it down before them. *Darwin.*

When seamen are thrown upon any of the unknown coasts of America, they never venture upon the fruit of any tree, how tempting soever it may appear, unless they observe that it is marked with the pecking of birds, but fall on without any fear where they have been before them.

Small birds baffle hawks by flying round and above them in great numbers.

Quills are for the most part plucked with great cruelty from living geese, and all persons from convenience, economy, and feeling, ought to prefer metallick pens.

Chickens are hatched by the heat of ovens by the natives of Berme, a village in Egypt. They hire themselves over Egypt for the purpose, and undertake to deliver $\frac{2}{3}$ds as many chickens as eggs. The ovens contain from 40 to 80,000 eggs, and there are 400 of them in different parts. Each brood occupies 21 days, and they work their ovens for 6 months, producing altogether 100 millions of chickens in 6 months.

Wild ducks are estimated to fly 90 miles an hour, swallows fly rather faster, and the swift is said to fly above 200 miles in an hour.

Birds which nestle in holes, as wood-peckers, wry-necks, robins, swallows, &c. have eggs of a shining white. Pale green or pale blue characterizes the eggs of the starling, fly-catchers, hedge sparrows, &c. A green colour in those who lay loosely among grass. The nuthatch titmouse and chimney-swallow are party-coloured with a white ground. Others not white, are larks and singing birds.

Modern classification does not rank cetacious animals as fishes, though they live in the sea. They suckle their young, and, therefore, are classed with man, &c. among mammalia. Their hands are large, and they have little or no neck. Their eyes are very small and backward. The tail is horizontal, and they have swimming paws, similar to the fore feet of seals. A single stroke with the tail of a whale will cut a boat in two; and they move in the sea above a mile in a minute. The stomach consists of four or five successive cavities. They live chiefly on other species of fish. The aorta of whales is thirteen inches in diameter. The blow-holes are nostrils at the top of the head to inspire air; and the blow-holes are so contrived as to enable it, at pleasure, to eject the water that enters the mouth. A large whale can form a jet forty feet high. Their structure is as anatomically curious and perfect as that of other mammalia, and they merit the respect and sympathy of man. In general they

are black. Those of Spitzbergen are white. The balænæ, or common whales, are often sixty feet long and thirty round. Instead of teeth they have whalebone plates, with hairy borders hanging from the upper jaw. The females are most affectionate to their young; and when assailed and wounded by the avaricious monsters who frequent these seas, their care of their young ones often draws tears from every eye-witness who is not capable of midnight murder. This class includes—

The common whale and Iceland whale	60 feet
Finned whales	50 feet
Nor-whales	21 feet
Spermaceti whale	60 feet
Dolphins	25 feet
Porpoises	6 feet
Grampusses	20 feet
Beaked whale	24 feet

The great whale is a very harmless animal, and has neither the habits nor the conformation of fishes. They have no teeth and very narrow gullets. Their horizontal tail, and the suckling of their young, bring them within the class of land animals. The barbarous practice of killing them for gain is akin to the traffick in the human species, which, till within these few years, disgraced commerce.

The dugong is a grazing sea animal, which, at the bottom of the sea, feeds on marine plants. It is as large as a cow, and is often seen in shallow water between the tropicks.

Sharks are often so large as to weigh 3 or 4000lbs.; living partly on vegetables, but voracious of every thing, and the terrour of tropical seas.

The delphinus, or dolphin genus of fishes, consists of the dolphin, porpoise, grampus, and leucas, or white fish.

The cod, according to Leuenhoeck, annually spawns nine millions of eggs; the flounder a million; the mackerel half a million; the herring ten thousand; the carp a quarter of a million; the perch more; and the sturgeon six or seven millions. Of the viviparous, the blenny brings forth two or three hundred. The spawn of one genus is mostly devoured by others, and not one egg in a hundred is supposed to be hatched.

There are nineteen species of that half-human inhabitant of the sea called seals. They are even more like men than monkeys are, and live in social communities, and display great sagacity and mutual affection. The females are specially interesting in their duties to the young; and among some species but one male and one female cohabit, while in others polygamy is practised with regular family government. For the sake of oil, man is their merciless destroyer. The smaller species are called sea-calves, and the larger, or ursine, sea-horses. They are often mistaken for the fabulous creature the mermaid.

That *lusus naturæ* the flying fish, has very large pectoral fins. When pursued by the dorados and other fish of prey, it rises into the air on these fins, and flies as long as they continue wet.

Many fish are very long-lived. Carp and pike have been identified for above 200 years. Their respiration is repeated every two or three seconds, and their gills are larger than the surface of their bodies; in this respect resembling the expanded lungs of animals.

The art of sailing is merely an imitation of the nautilus. There are thirty species; some so large that drinking cups are made of their shells. The fish is independent of the shell. In sailing it stretches out two of its arms, which hold up a membrane as a sail; and with two other arms and its tail, rows and steers. The prodigious number and size of those in a fossil state proves that they were at one period more important than they have been since. Man has exerted his power as the universal destroyer.

The monoculus, or crab genus, has fifty species, distinguished into seven sections, as they have one or two eyes or one or more shells.

All flat fish are comprised in the genus *pleuro nutes:* species of which are the flounder, halibut, plaice, sole, turbot, dab, &c. They have their eyes on the right side.

A sea-snake was cast ashore in Orkney, which was fifty-five feet long, and the circumference equal to the girth of an Orkney pony.

The cod-fish, or gadus, which supplies the Catholicks with such luxurious repasts on their *fast*-days and in Lent, abounds in shoals on the coasts and banks of Newfoundland, Cape Breton, and Nova Scotia. They are from 14 to 40 lbs. and larger.

Mackerel, &c. pass the winter in the mud or sand in deep water, and emerge in the spring.

The air-bladder of fish enables them to rise or sink at pleasure; and this power, and that of the fins and tail, gives the largest a speed many times greater than that of any ship.

Aristotle divides shells into three orders, univalves, of one piece, and bivalves, and turbinated; and the same arrangement is still preserved, except that the order is changed by Linnæus, and the turbinated are called multivalves; and he divides them into three genera of multivalves, fourteen of bivalves, and nineteen of univalves. Latreille has since published another arrangement in 153 genera, but not more satisfactory. The best work on British shells is by Donovan. In univalves, in some species, the cavity is divided into chambers, with a pipe of communication; the base is the mouth and opposite is the apex. The convolutions are called whorls. The hinge in bivalves is sometimes furnished with teeth, it is usually joined by a strong ligament. They adhere to rocks by a thread-like substance, called the beard. The forming of collections of these natural trifles is accompanied by the cruel practice of plunging the shell in boiling water to kill the animal; and, in some cases, this has not succeeded, for shells put away as dry have sometimes been found crawling, and after a considerable lapse of time.

The shell of a sea cockle is the circulating medium of Angola and the neighbouring kingdoms. The cockles are caught on the shores of the island Loanda, held by the Portuguese, who, therefore, make the people tributary.

Snails shut in a box with air close themselves in their shells, and live in a dormant state for months or years and revive in water at 72°.

The snail called *helix formatio* is eaten at Rome by the people during Lent, being fattened purposely. When snails attack fruit, they touch no other till that is gone: hence gardeners never remove them. Their eyes are at the end of each horn. Lice are found on their bodies, and worms in their intestines.

A shower of crabs fell with heavy rain, in the summer of 1829, in the yard of the Poor-House at Reigate, and were lively, weighing two ounces.

The bony scale on the back of cuttle fish is used for tooth powder and pounce. This fish squirts a black fluid like ink.

The Persian pearl fishery is carried on at the Bahrin Islands, in the Persian Gulf. The vessels amount to many hundreds, and the pearls weigh from ten to fifty grains.

Oysters differ from muscles in being attached where they grow. They spawn in May, like drops of candle grease in water, which attach and grow for three years. On the coast of Coromandel they are two feet in diameter.

Two polypes cut asunder, and joined at either end, become one; and one species may be turned inside out, and live as before.

Throughout the Australasian seas there is scarcely a league without a coral reef, rock, or island, raised from the bottom of the sea by marine polypi, though the sea itself is fathomless. Some are in deep water, others with a few rocks above the surface. Some in islands, but without vegetation, others with a few weeds on the higher parts, and some covered with large timber, though the sea is unfathomable close to the rock. It appears that the birds settle as soon as the reef rises above the water, and their dung, floating wreck, with seed and cocoa-nuts, lay the foundation of vegetation. Captain Flinders conceives that in due time, the whole of that sea will be united in one extensive continent. The whole of the eastern coast of New Holland is filled with corals. Flinders sailed 500 miles in fourteen days before he could disentangle himself. On landing on a newly formed one, he found wheat-sheafs, mushrooms, stag's horns, cabbage-leaves, and other forms, growing under water. These creations arise from the insects continu-

ally raising a wall to leeward higher and higher, as a shelter from the wind and waves.

There are three celebrated coral fisheries in the Mediterranean, but corals are procured in many seas. The best is procured in submarine caverns. It is enlarged by the insects which generate it, like vegetables. It is ten years in attaining its full height of a foot. There are nine shades of red, and several of white coral. It grows in depths from 60 to 600 feet. In growing it preserves an exact perpendicular direction. In the South Seas the little animal raises the bases of islands of this hard material, carrying it nearly to the surface of the water, forming at first dangerous shoals, which ultimately become fertile islands.

Dracuneuli are thin long worms which, in very hot countries, breed and grow in the muscular parts of the body, to the length of four or five yards.

The order mollusca of vermes, are all more or less phosphorescent, a power which enables them to illuminate deep waters.

There are forty species of animal anemones or actiniæ. They are beautiful in structure and wonderful in their economy. They are of a cylindrical figure, or pear or funnel-shaped, but often like a marigold or rose. They are found firmly fixed on the rocks washed by the sea. They swell or contract at pleasure. They devour fish, crabs, &c. as well as flesh. They spread their numerous arms, or tentacula, and if one seizes any prey, the rest unite in securing it, and carrying it to the mouth. They are hermaphrodite, and cast their young from their mouth; and they often divide and become two animals; and so if cut into several parts, which, if torn away, the very shreds become perfect actiniæ. They cannot live in fresh water. They have sensitive feelings, shrink in case of danger, and enjoy the light, but no eyes have been traced. They can detach themselves to float in the sea.

Sponges are believed to consist of excitable flesh, full of small mouths, by which they absorb and eject water.

The phosphorick light seen in the ocean is caused by innumerable quantities of phosphorick insects, and is sometimes so intense as to make the waves appear like red-hot balls.

There are two classes of animalculæ, seventeen genera, and 378 species. The first class, of ten genera, consists of worms in various forms. The second are worm-like, with additions; and most of them are visible only with the microscope.

They are produced by mixture of various substances in fluids; and by some supposed to be spontaneous, while others have referred their origin to various causes.

Hempseed, rice, lentils, peas, pepper, beet-root, blighted corn, &c. all yield various kinds on being macerated in water; and however much boiled, the smaller kinds appear. Vinegar, too, produces eels, and all animal substances in putrescence display them. There are none in fresh rain water or pure spring water. Sea water, when used for the solution, produces them in swarms.

The itch, according to Willan, is caused by an insect, white, with eight reddish legs, to the four hind ones of which is appended a bristle. It may be distinguished with the microscope in the vesicles in the joints, which accompany the disorder. On the same authority we learn that most of the diseases of the skin are occasioned by other insects.

Lewenhoeck saw hundreds of animalculæ in the space of a grain of sand, and he says ten thousand, but it is now suspected that he saw the ultimate motions of the atoms of gas and not organized beings. A drop of water contains hundreds, all in extreme activity, swimming or crawling with freedom and purpose. They appear to subsist on the atoms of the infusion, and some prey on others. Some have the form of flying dragons with all their parts, others are like polype, some like worms, others with many legs like insects, while others have machinery of wheels which turn, create vortexes, and apparently enable them to collect food. Some are like plants, with branches each terminated with an animalcule, and the trunk and branches alternately draw in and spread. Others are like hydatids, and have their ge-

nerations in the skin. And all appear to be hermaphrodites.

Many animalculæ have the power of resurrection, and after being dry grains for years, revive again on being put in a drop of water, and this may be repeated 10 or 12 times, if they are kept in sand, however dry.

They abound as a sort of tadpoles in the semen of all male animals, from man to the smallest insect.

The foul matter of dirty teeth abound in a sort of eels. Diseases of the skin are generally occasioned by them, or they accompany such morbid parts in various forms.

The little animal which makes rapid circles on water is the gyrinus or water flea. When disturbed they dart into the water.

Animalcules are not to be found in all fluids. None are to be found in wines, or any other fermented liquor which has not passed into the state of vinegar, or which has not become completely vapid, neither are they to be found in distilled or spring water. About three hundred of these minute animals are described by naturalists, and arranged in fifteen genera, or families. The principal one is called vorticella, from the mouth being surrounded by numerous short feelers, forming a kind of fringe round the head; and by the motion of these feelers they form an eddy or vortex in the water, which draws their prey into their mouths. The wheel animal has, also, the very extraordinary property of reviving after it has been left dry for some months on a glass.

If paste made with flour and water is suffered to go sour, without becoming mouldy, the surface will soon be found covered with an infinite number of minute living beings, which, from their general similarity to that animal, have been called eels. The same animals, or as some authors think, a different species, is found in bad vinegar, and other mild acids. These animals are viviparous, and their increase is astonishing, but a hundred or more have been seen to issue from one single eel.

The volvox globator, or globe animal, is one of the most curious as well as one of the most beautiful of the animalcules; it is found in the clearer kinds of stagnant waters, and often equals the size of a pin's head. Its general colour is green, but it is sometimes of a pale orange; its motions are irregular in all directions, and at the same time rolling or spinning as if on an axis. When microscopically examined, it presents one of the most curious phenomena in natural history, being always pregnant with several smaller animals of its own kind, and these with others still smaller.

Cheese mites are found not only in cheese, but in preserves, meal, dried flesh, and other articles of domestick consumption; they have as regular a figure, and perform all the functions of life, as creatures that exceed them many times in bulk; they have a sharp snout, and a mouth that opens and shuts like a mole's; they are so extremely quick-sighted, that when they have been once touched with a pin, they avoid a second touch. The various parts of the body are covered with long hairs, and even these hairs are bristly. From the eggs of the females the young are hatched in twelve or fourteen days, and are so small that ninety millions are not so large as a pigeon's egg. Their manner of feeding is by thrusting alternately one jaw forward and the other backward, and in this manner grinding their food, and after they have done feeding they seem to chew the cud.

The wings of insects afford an immense variety of interesting and beautiful objects. Some are covered with scales, as in the butterfly tribe. Some are adorned with fringes of feathers, and the ribs or veins are also feathered, as in many of the gnat family, and even these scales and feathers are ribbed and fluted in a variety of ways. The earwig is not generally known to have wings, from their being folded up on the back into so small a compass. In size wings differ as much as in every other particular, some are so minute as to be scarcely perceptible, and others are several inches in length. The elytra, or wing-cases, of many insects are beautifully transparent objects, such as those of the boat-fly, the grasshopper tribe, and many of the minute cicadæ, or frog-hoppers, &c.

The greater part of the head of most flies is taken up by two protu-

berances, which on minute examination with a common magnifier seem to be reticulated, or similar to net work. These are the animals' eyes, and consist of an immense number of convex lenses. In the libellula, or dragon-fly, there have been counted upwards of 25,000 of a hexagonal figure and a brilliant polish. The eyes of crabs and lobsters, and all that family, consist of lenses of a square form.

In digging ponds in the interiour of countries it is found that in some countries they soon abound in various fish. The soil having been under the sea in remote ages the spawn may exist in the sand, the fish being vivified by the access of water just as the germs of animalculæ are revived by water in the vegetable substances infused; and into which they may have been conveyed by the circulation of the plant.

The instincts of animals are their habits and practices resulting from their varied forms and natural powers. They fly, swim, crawl, run, &c. and eat and locate agreeably to their respective experienced convenience, and the young universally follow the habits of their parents, and education becomes their nature generating peculiarities in each kind. They thus replenish the earth, promote its intense fertility, and become useful and necessary parts of a general circle of organick life.

All animals display varied and strong intelligence, but we notice most those acts which resemble our own. Thus, the species of the motacilly, called the tailor-bird, astonishes by sewing two leaves together with vegetable fibres as with a needle and thread, for its nest. The nightingale, wren, robin, &c. are other species.

All animals derive their heat and nervous power from the chymical combination of the oxygen in the air with antagonist elements in the lungs or parts equivalent; and their power of locomotion from reacting by their muscles against the earth, water, or air.

Reproduction is also evidenced in the growth of trees from slips and cuttings, of polype and worms from small fragments, and of the renewal of the claws of crabs and lobsters with all their nerves and parts in perfection.

The power of reproduction in insects is one of the most wonderful parts of their economy. On beheading a slug, a new head with all its complex appurtenances will grow again; so will the feet of a Salamander and the claws of lobsters. The end of a worm split produces two perfect heads, and if cut into three pieces the middle reproduces a perfect head and tail.

The periods of gestation are the same in the horse and ass, or eleven months each. In the camel twelve months. In the elephant two years and in the lion but five months: in the dog and cat two months: in the cow nine months, and in sheep five months. The hen sits 21 days, the goose 30, and the duck 30.

In 1813, a boa constrictor was killed in the isle of France, 14 feet 6 inches long; in his stomach were found several animals, as monkeys, &c. half digested.

There are 81 species of lacerta or lizard, of which the crocodile, the alligator, and guana are the chief. Those in England are very inoffensive, timid creatures, and one species is the water newt, three or four inches long.

Twelve species of crocodiles have been distinguished, four of which are called alligators and two gavials. Those of the Nile are the largest, but they are now very uncommon; at least in lower Egypt where a crocodile would be regarded as a great curiosity. Their form is that of a lizard, sometimes thirty feet long, and nine or ten feet round. The body is covered with scales, hard enough to turn a musket ball; with a mouth several feet long, filled with teeth like a saw. They pursue their prey with agility, but cannot turn, and, therefore, are easily escaped; but whatever is once caught is held fast, and if large drowned. They roar like a bull, and in winter are said to be torpid. The females lay from thirty to one hundred eggs in a season, but they are destroyed by the ichneumon; and some species of tortoise destroys their young. They are so tenacious of life that it is very

difficult to kill them. If well fed they become tame; and Labat, an African traveller, asserts that they are seen in villages without dread, and even played with by children. Their usual ferocity being ascribed solely to hunger. The excrements are vomited up and the crocodile is obliged to come on shore as often as he has occasion to ease himself.

The testudo or tortoise is so long lived that two are recorded in England who lived 120 and 200 years, They know their friends and display much intelligence. The turtle of this genus is very large and subject to great cruelties to satisfy the whim of epicures.

There are ten species of scorpions, mostly venomous, and some large.

There are 36 species of the rana or frog genus, including toads, the whole being innoxious, while the common toad is curious from its longevity when enclosed in hollows of trees, and stones, and the Surinam toad from its producing its young from cells in its back. The American bull-frog 18 inches long, is so called from the frightful noise it makes in the woods.

The progressive motion of serpents is effected by raising the body into arches, and fixing their hinder scales into the ground, and in this way they move backward and forward, the ribs concurring with an active motion. They mostly swallow their food entire. The heart possesses two auricles and one venticle, and they all breathe. Hogs and goats kill and devour them. They live on land or in water either salt or fresh. The boa constrictor is from twenty to thirty-six feet long and is capable of swallowing deer, calves, or men whole, first crushing the bones by the strength of its folds; it usually catches its prey by hanging from the branch of a tree near the places where animals go for water, and its destructive powers are as above, for it has no poison fangs. The colubre is from thirty to forty feet. The ringed or spotted snake found on dung hills in England is perfectly harmless, as are others, except one, and most of them may be tamed. The rattle-snake is from 5 to 8 feet long, but does not attack, and gives warning by the noise of rattling its tail. Eleven genera of serpents have no poison fangs and 19 have, but compared with the others they are very few in number. The chief of them are the rattle-snake, the crotalus of Carolina, one genus in Madagascar, another in Martinique, the naja of India and South America, the black adder of Sweden, and the viper or adder found in England and other European countries, which is about two feet long, the colour gray, with a chain of irregular spots on the back.

ANATOMY AND PHYSIOLOGY OF MAN.

The genus man is divisible, according to colour, into four species; the white, the copper-coloured, the tawny, and the black. The whites are sanguine or reddish, dead white, and dark. The tawny are brown and dark brown, as the Arabs, Jews, Hindoos, Persians, &c. The dark brown are the Calmuck Tartars, Chinese, and Gipsies. The copper-coloured are the native Americans. Other dark brown are the Malays and South Sea Islanders. The blacks are Negroes, with woolly hair, and Caffres, &c. with straight hair.

The body consists of brain and nerves for sensation, muscles for motion, bones for strength, glands for secretion, arteries and veins for circulation, lacteals and lymphaticks for absorption, and lungs for heat and vital energy.

Anatomy is the knowledge of the mechanical structure of the parts of the body. *Physiology* treats of the powers by which they produce their results in the living body. *Pathology* treats of diseases and their symptoms, the classification of which is called *Nosology*. *Therapeutics* treat of cure, and medicines to be applied, and includes the *Materia Medica*. *Pharmacy* is the art of compounding medicines, and *Posology* determines the doses.

The human body consists of—
240 bones,
9 kinds of articulations or joinings,
100 cartilages and ligaments,
400 muscles and tendons,
100 nerves;

besides blood, arteries, veins, glands, stomach, intestines, lungs, heart, liver, kidneys, lymphaticks, lacteals, and three skins, the epidermis, the rete mucossum, and the true skin, beneath which is the tela cellulosa, distributed through the system, and surrounding every muscle and fibre, every artery, vein, nerve, and lymphatick.

The circulatory system consists of the heart and arteries, and of the veins and lungs. The compression, or systole of the left auricle, forces the red blood into the arteries; it is then brought back purple by the veins to the right auricle, compressed by it through the lungs, and reddened and vivified, is passed by the pulmonary veins to the left auricle, which expels it again through the system. Such is the economy of all animals, the greatest and the smallest, the most egotistical and most despised.

The vivification of the blood appears to arise from its chymical combination with oxygen, which thereby parting with its previous motion, that motion received by the blood is animal heat and the power and energy of the system, or the principle and cause of vitality. The arteries distribute universally, and the distinct veins absorb universally, taking up the nitrogen of the air at the skin, and the carbon of the system. Hence the chymical combinations in the lungs, expiration of carbonick acid gas, and the restoration of the excitable powers of the blood. Vital action in animals is simular to combustion, except that owing to the fluids, ignition does not take place.

The stomach converts food into a pulp called *chyme*, and passing into the intestines, *bile* converts it into a milky substance called *chyle*, in which state the lacteal absorbents convey it to the blood near the heart, through which it passes to the lungs and becomes blood.

There are 41 arteries or great branches which have received names. The *pulmonary* proceeds from the right ventricle of the contracting heart to the air-cells of the lungs. The *aorta* from the left ventricle through the system, and after rising to the first rib, crosses in an arch the thorax and belly, and divides into two. Others are branches of these. The arteries felt behind the wind-pipe are the carotid: the artery which runs over the jaw bone, and its branches which supply the lips and face, is the facial or labial artery and a branch of the carotid. The artery felt at the temples is a seventh branch of the carotid, and called the temporal artery. The artery which passes inside of the arm is called humeral.

Bones are composed of gelatinous fibres in net work, and of earthy salts, as phosphate, carbonate, and sulphate of lime. The gelatine prevails in young animals, and hence their bones are more flexible. In the fœtus the bones are gristly, and ossification commences at their centres. Bones have blood vessels.

The bones in the head consist of—

1. Frontal or coronal.
2. Parietal.
3. Temporal.
4. Occepital.
5. Sphenoid.
6. Ethmoid.
7. Nasal.
8. Ungual.
9. Cheek.
10. Upper jaw.
11. Palate.
12. Spongy or nostril.
13. Vomer or nasal.
14. Lower jaw.

There are three sutures, the coronal, the sagittal, and the lamboidal.

The head has 77 muscles.

8 for the eyes and eye-lids.
1 for the nose.
8 for the lips.
8 for the jaw.
11 for the tongue.
11 for the larynx.
11 for the ear.
17 for motions of the head and neck.
1 to move the hairy scalp, and another the eye-brows.

The muscles of the human jaw exert a force of 534 lbs. and those of mastiffs, wolves, &c. far more. The force is produced by the swelling of the muscles in the middle, and dilating again. The entire muscular system to the ground concurring by the vigorous reaction called health. Those muscles which perform involuntary motions receive nerves from the spinal marrow and cere-

brum, and those voluntary from the cerebellum.

New born infants are twenty-one inches long, and weigh from 10 to 15 lbs.

The four front teeth in each jaw come first in eight or ten months; the four canine or eye teeth in ten months; the sixteen grinders from twelve to fourteen months. At twenty-two or twenty-four years, four other grinders come, making thirty-six.

Absorbents which convey chyle to the thoracick duct are called lacteals; and those which collect other fluids in the system, and convey them to the same duct are called lymphaticks. The lacteals, lymphaticks, and their glands, the mesenterick glands, and the thoracick duct, are the absorbent system. The fluids taken up by the lymphaticks are prepared by the lymphatick glands; and the chyle is prepared by the mysenterick gland, before either pass into the thoracick duct, situated on the right side, near the first vertebræ of the loins. It ascends to the left side of the neck, and enters the venous system at an angle formed by the subclavian and jugular veins, in the passage of the venous blood to the lungs.

The chest, filled by the lungs, extends from the neck to the pit of the stomach, and is lined with the pleura, a firm fibrous membrane. The lungs are large spongy substances; and the right lung is divided into three lobes, or divisions, and the left into two. They are of lighter colour in youth than age, glossy and elastick. They join the windpipe, heart, and spine, but in other parts are free. They are composed of cells, of innumerable ramifications of blood-vessels in the cells, for exposure to the inspired air, and of nerves and lymphaticks.

The wind-pipe is composed of sixteen or eighteen cartilaginous rings, about the twelfth of an inch broad, and joined by elastic ligaments.

The diaphragm, whose action compresses or dilates the lungs, and on which they rest, is a fleshy partition which divides the chest from the belly. It is arched towards the lungs, but flattens during a strong inspiration, and rises during a strong expiration. The dilating muscles are four, with ten auxiliary, and the contracting are six, with four auxiliary.

The larynx, or organ of voice, is a cavity composed of moveable pieces, twice as large in men as women. Its five cartilages are moved by eight pair of muscles, and fifteen other pairs are connected with its varied powers.

The small intestines are four or five times longer than the whole body of the body to which they belong.

The spleen, of which the use has not been discovered, is found in all vertebral animals. It is always near the stomach, and near the first in those that have several.

The gall-bladder in the human subject is in the shape of a pear, and the size of a hen's egg. It lies on the concave side of the liver. It sometimes forms calculus secretions, which, in passing to the duodenum create great pain and danger.

The diaphragm is the membrane which divides the thorax from the abdomen.

The diastole is the expansion of the heart, &c.; and the systole is its contraction.

The skeleton of a man weighs from 12 to 16 lbs. and the blood 27 or 28 lbs.

In monstrous births without brains, the functions of vitality procced.

A female skeleton of the same age is smaller than a male. The head, hands, and feet are smaller, the neck longer, the pelvis wider and deeper, and the prominences less.

The specifick gravity of blood is from 1085 to 1126, and its temperature is from 97° to 102°.

The human figure is equal to ten faces. One-third from the crown to the forehead; one to the chin; to the pit of the collar bones two-thirds; from the pit to bottom of the breast one; from the bottom of the breast to the navel one; from thence to the privates one; to the knee two; the knee half; from the lower part of the knee to the ancle two; and to the sole half:—in all ten. When the arms are extended, the distance of the tips of the longest fingers are equal to the height. From one side of the breast to the other is two

faces; from the shoulder to the elbow two; from this to the root of the little finger two. The sole of the foot is a sixth of the height. The thumb equal to the nose. The teats and pit between the collar-bones of a woman is an equilateral triangle. The length of the face and hands is equal. Such are the proportions of painters and sculptors in perfect figures.

The facial angle is the horizontal angle formed by a line, parallel to the bottom of the nose, with another line from the level of the upper jaw to the ridge of the frontal bone. It is

In Europeans	from 75 to 85°
In American Indians	73½
In Africans	70
In ourang outangs	65
In monkeys	57
In dogs	40
In sheep	30
In a horse	23

The number of teeth at maturity is thirty-two, or sixteen in each jaw. The eight front ones are called cutting teeth; and the two next on each side are called dog or eye teeth. The two next are two pointed teeth; and the three next on each side are called molares, or grinders. The two last are called wisdom teeth, as they are cut last.

Teeth are phosphate of lime and cartilage, but the enamel is without cartilage.

The teeth of an adult have a specifick gravity of 2.27; and those of children 2.08.

The brain, under the skull, is invested with the dura mater, a membrane with arteries.

Within the *dura mater*, and adhering to the brain is the *pia mater*, a very fine transparent membrane, filled with blood-vessels; but a finer membrane lies above this, called membrana arachnoidea.

The brain is called the *encephalon*. Its portions are the *cerebrum*, which occupies the top and front of the skull; the *cerebellum*, which rests on the base of the skull behind, and separated from the cerebrum by a fold of the *dura mater;* and the *medulla oblongata*, or commencement of the spinal marrow, which projects upward into the centre of the encephalon.

The whole is composed of soft pulpy matter, in various convolution and prominences.

The cerebrum has three lobes, or round parts; the middle called the corpus callosum: and it consists of two kinds of matter, the outside reddish-gray, and the middle bluish-white, and softer.

The cerebellum has two lobes, and is of firmer consistence than the cerebrum.

The medulla oblongata lies between the lobes of the cerebellum and the middle lobe of the cerebrum, from which it is separated by a streaked medullary part, called the pons varolii.

The *spinal marrow* is a continuation of the *medulla oblongata*, which, unlike the *cerebrum*, has the bluish-white outside and the reddish-gray inside. It is divided down the middle, and enclosed by the pia and dura mater.

The four are considered as the common sensorium. The cerebrum being the organ of sensation; the cerebellum of the will, and the medulla oblongata and spinal marrow extending their functions to the system. The weight is nearly four pounds in a male adult, and in the female not so much.

A tenth part of the whole mass of blood is continually in the encephalon.

From various parts of the encephalon, and from the spinal marrow, pass white medullary chords in parallel waving threads, and invested at first with the dura mater, and then with a cellular membrane. They run in pairs; and one is for sense, the other for motion, when both objects are to be effected. They often unite in a knotty cluster, called *ganglions*, which send out more fibres; and some different nerves, unite in network, called *plexus*.

Nine pairs proceed from the encephalon, and thirty from the spinal marrow.

Modern physiologists divide the vital powers into muscular contractility, nervous agency, sensorial power, and organick affinities. The origin of these modes of excitement appears to be the power which is derived by the lungs from the energy of the atmosphere; which energy is

transferred by them to the blood and to the system. The gas respired consists essentially of atoms in circular motion; by chymical union a portion of these part with their motion in the lungs, and those motions are transferred to the system.

The prime agent in animal systems is described to be the cellular tissue, or membranes, which extend through every part of the body, under various names and functions. It constitutes what is called tone, and vigour in the system, which depend on the facility of its contractions.

The cause of muscular contractility has produced numerous theories, with which anatomists have not mingled animal experience, but have regarded the power of muscles as powers *per se*. Nervous agency has also produced numerous theories, the nerves being considered as separate from the general identity of the animal. Sensorial power has also been examined as a property of the substances, and not as a result merely personal.

The most important discovery relative to the nerves has been lately made by Mr. Charles Bell, who proves that nerves are not single, but that the combination possesses different powers; two filaments being united for convenience of distribution, while their office and their origin are distinct. The tongue, for example, has nervous papillæ for taste, and others for feeling; one sort communicate pain or feeling, and the other the sense of taste. Mr. Bell shows that the nerves which proceed from the front and back of the spinal marrow have totally different functions, though they spread through the system in pairs and in contact. Those which issue from the posterior part might be cut without convulsing the muscles; but the mere touching those from the anterior part produces convulsions. One set he finds to perform the functions of sensation and the will, exquisitely sensible and universally diffused; the other set are connected with the functions of respiration, circulation, secretion, and muscular motion.

The brain itself appears to have distinct functions like the nerves; the chief part of it may be cut away or removed without affecting the power of voluntary motion or giving pain, and this part is considered as the *cerebrum*, which appears to be the organ of sensation; the animal, on its being removed, losing its powers of sensation: while, if the cerebellum or posterior part, is removed, the animal loses the power of voluntary motion. The organ of feeling in this analysis appears to be the *medulla oblongata*, and adjoining part of the spinal marrow.

These facts being established by various experiments on living animals, often exceedingly cruel, it may be hoped that they will not be repeated from motives of wanton curiosity.

In less complicated animals, Mr. Bell found the nerves for different purposes more decidedly distinct than in the higher classes.

In the fœtus, the first part of the nervous system that is formed is the spinal marrow; the upper part of which is enlarged, and the brain succeeds. The sensorial powers are not developed till the frame-work of the body is matured; and their continuance depends on the perfect cooperation of the circulating system.

Gall considers the brain as a collection of distinct organs, the form and expansion of which distinguish the intellectual powers and predominating passions of individuals. Its functions are three—organick, sensitive, and intellectual; to each of these purposes he assigns a particular organ. He divides the parts of the encephalon into twenty-seven organs, in three classes; those of organick life one; those of sensation and perception; and those which relate to reasoning and intellectual energy, on the vertex and smooth part of the forehead, which expands as animals advance in intellect.

In cases where the brain has been removed, there has been no production of heat from respiration artificially kept up.—*Brodie.*

When the nerves to any gland are injured or divided, the secretion of the gland is modified in quantity or quality.—*Home.*

Nine pair of nerves issue from the brain, and the other thirty-one from the spinal marrow. The nervous system has an intelligence: which

has been considered analogous to the web of a spider, or the net of a fisherman.

A healthy liver weighs nearly 4 lbs. but diseased ones become four or five times heavier.

The number of ribs vary, being twelve or thirteen on a side.

In ordinary respiration, 16 or 17 cubick inches of atmospherick air pass into the lungs 20 times in a minute, or a cubick foot every 5.25 minutes; 274 cubick feet in 24 hours, or a cube of 6½ feet each way. The lungs hold 280, and at each expiration 1.375 of the oxygen is converted into carbonick acid gas; in 63 minutes a cubick foot, and nearly 23 feet in 24 hours. The loss in bulk, per respiration, is but .006 or 0.12 per minute, or only the tenth of a foot in 24 hours. The nitrogen inspired and expired is exactly equal. If then the relative specifick heat or atomick motion of oxygen, and carbonick acid, as the mean of Crawford and Dalton be taken as 3.65 to 1; and the absolute heat of a cubick foot of oxygen, as 876°; the difference between inspired oxygen and expired carbonick acid is 688° for every foot in 63 minutes, 0.53° per respiration, or $688° \times 23 = 15824° + 87.6°$, or 15911.6° in all, for heat and strength in ordinary respiration per day.

Vegetable aliments are gum, jelly, starch, gluten, oil, sugar, and acids.

Animal aliments are *gelatine*, or jelly, *albumen* as the white of an egg, *fibrine* or muscular fibres, and *fat*, also *blood* and *milk*.

Puberty in northern climates commences from 15 to 20, but in India and Arabia from 11 to 14. Age in the former from 45 to 70, and in the latter from 30 to 45.

Contracting muscles are called *flexor* muscles; expanding muscles *extensor;* the pair *antagonists*.

Lime combined with phosphoriek acid is the basis of bones, and found also in the fluids. Shells consist of carbonate of lime; and hence their remains have been considered as the basis of lime-stone mountains. Silica and manganese are found in the hair. Iron, with phosphoriek acid, constitutes part of the blood.

The fluids of animals contain alkalies, especially soda.

The specifick gravity of red arterial blood is one-twentieth greater than water. The *serum*, or whey part, is but one-fortieth heavier than water; but the cruor, or coagulated part, is one-fourth heavier than water. The serum coagulates in water nearly boiling; and consists of gelatine, soda, phosphate of lime, and ammonia. The cruor contains subphosphate of iron, and some soda and albumen.

Venous blood is dark or crimson; but restored to its red colour by passing through the lungs.

The heart, by its muscular contraction, distributes two ounces of blood from seventy to eighty times in a minute.

The spinal cord is formed in the fœtus before the brain, and animals are perfect as it is perfect.

The sense of feeling is created by the papillæ of the skin, consisting of small white nervous fibres, which erect themselves when the sense of touch is excited.

The sense of taste by the tongue and palate, by means of nervous papillæ.

The sense of smell is in the nerves of the pituitary or mucous membrane.

The sense of hearing is effected by a mechanism which conveys the vibrations to the internal parts, where nervous fibres are distributed. The drum of the ear is called the *membrana tympanum;* and its vibrations are conveyed to four bones in the internal cavity, which again propagate the vibration to a double spiral cavity, called the *cochlea*.

The eye is an optical instrument. The outer coat is the *sclerotick* membrane. The fore part is the *cornea*, made up of concentriek layers. Between this and the former lies the white of the eye, covered by the *membrana conjunctiva*, that lines the outside of the eye-lids.

Within the sclerotica, and concentriek with it, is the *choroid* membrane. At the back part it is perforated by the optick nerve, where it forms the *retina*, which covers the choroid.

About three-fourths of the globe are filled with the vitreous humour, like the white of an egg. In front is

the crystalline lens, convex on each side, but more so inward. It is composed of transparent laminæ, more dense towards the centre. The front is filled with the aqueous humour, in the middle of which floats the iris, or coloured membrane. The specifick gravity of the humours is but a 200th more than water; but the lens one-thirteenth more than water. They consist of water and albumen and gelatine. The iris is supplied with blood-vessels and nerves, and is very irritable, contracting and dilating to the light, and appearing to be governed by the retina.

Between the ball of the eye and the vault of the orbit lies the lacrymal gland which secretes tears, and consists of two lobes with several small canals.

The blind youth who was couched by Chesselden in his thirteenth year, thought scarlet the most beautiful of all colours; but black was painful. He fancied every object touched him. He could not distinguish, by sight, objects which he knew by feeling; and was some time learning to distinguish, by his new sense, between the cat and the dog. Those things which he had liked best, were not equally agreeable to his sight; and he had to learn by sight the name of every thing he saw, constantly forgetting and mistaking one thing for another. Pictures he considered as party-coloured surfaces, and he had no idea of the effect of light and shade; a miniature portrait much astonished him, it seemed like putting a bushel into a pint. He could not conceive how the house could look bigger than the room. He said every new object was a new delight. An extensive prospect he called a new kind of seeing. When his second eye was couched, he said he thought objects did not appear so large to this eye as they did at first to the other; and on viewing the same object with both eyes, he said they appeared twice as large. He and others, whom Mr. Chisselden operated upon, described it as learning to see; and, at first, had great difficulty in directing their eyes to an object.

Sir Everard Home couched some young persons with results exactly similar to those of Chesselden. They could not tell the name of any object till they were told what it was, or till they felt it, and had no idea of distances. The blind, however, make up for defect of sight, by the accuracy and sensibility of their touch, and by habits of association between the touch, memory, and judgment. Stanley, the organist, and many blind musicians, have been the best performers of their time; and the blind discriminate sounds at a distance with infinitely greater precision than persons who depend on their visual organs. Miss Chambers, a schoolmistress at Nottingham, could discern that two boys were playing in a distant part of the room instead of studying their books, though a person who saw them, and made no use of his ears, could not perceive that they made the smallest noise: and in this way she kept a most orderly school: so professor Sanderson could, in a few moments, tell how many persons were in a mixed company, and presently discriminate their sexes by the mere rustling of their clothes. Stanley, and other blind persons, played at cards by delicately pricking them with a pin. A French lady could dance in figure dances, sew tambour, and thread her needle. The ear too, guides as to distance, by reflection of sound, and within these few years a blind man, from his infancy, was a surveyor and planner of roads in Derbyshire. When a sense is wanted, the other senses are cultivated with care.

The colour of the skin depends on the colour of the rete mucosum, a soft gelatinous cellular substance, which lies between the cuticle or scarf skin and the cutis or real skin. In blacks this membrane contains a black fluid. The blood of blacks and whites is the same colour, and the darkening of the rete mucosum is ascribed by Blumenbach to carbon and to the increase of bilious secretions in hot climates.

There is iron enough in the blood of 42 men to make a plough share weighing about 24 pounds.

A man is taller in the morning than at night to the extent of half an inch or more, owing to the relaxation of the cartilages.

The human brain is the 28th of the body, but in the horse but a 400th.

The lungs, owing to the continued local accession of fresh cold air, are the coldest part of the body, and the degrees of heat which they generate is successively carried away by the blood.

The non-naturals are air, food, and drink, sleep, and watching, motion, and rest, the passions, and the secretions and excretions.

Food is converted in the stomach into a pulpy mass called chyme. It then passes into the pylorus and duodenum and is converted into chyle, which is taken up by the lacteals, while the mass is passing the intestines, and the excrementitious parts pass through the colon and rectum.

The Englishman's skull averages 7 inches in diameter, and the female $6\frac{3}{4}$. Yorkshire, &c. averages $7\frac{1}{4}$; and Scotland $7\frac{3}{8}$.

It has been computed that nearly two year's sickness is experienced by every person before he is 70 years old, and therefore that ten days per annum is the average sickness of human life. Till forty it is but half, and after fifty it rapidly increases.

Endemick diseases are those of districts; epidemicks are those of seasons or particular times.

So great, says Dr. Currie, are the difficulties of tracing out the hidden causes of the disorders to which this frame of ours is subject, that the most candid of the profession have allowed and lamented how unavoidably they are in the dark, so that the best medicines, administered with the wisest heads, shall often do the mischief they intend to prevent.

f there be any universal medicine in nature it is water; for by its assistance all distempers are alleviated or cured, and the body preserved sound and free from corruption, that enemy to life.—*Hoffman.*

Dr. Young divides the remedies of the materia medica into four classes; mechanical agents, chymical agents, vital agents, and insensible agents:

1. Air, diet, habits, passions, &c.
2. Caustieks, astringents, &c.
3. Excitants, catharticks, &c.
4. Specifieks.

A *dispensary* supplies medicine for the poor on application, and superintends the effects at their own houses. A *hospital* receives them as patients, and provides for them as long as medicine can relieve them, and advises in case of personal application as out-patients. An *infirmary* unites the objects of both. But there are NO PUBLIC ASYLUMS for convalescence and virtuous old age.

Vegetable poisons are numerous, the *acrid* are briony root, bitter apple, hellebore, spurge, wolfsbane, meadow, anemone, narcissus, and ranunculus. The *narcotick*, as hemlock, henbane, laurel, opium, stramonium, tobacco, coculus indicus, foxglove, nux vomica or ratsbane, meadow saffron, elaterium, fool's parsley, and fungi. The mineral poisons are arsenick, corrosive sublimate, oxalick acid, sulphurick acid, nitrick acid or aquafortis, verdigris, white vitriol, and white lead. Among the gases, carbonick acid, nitrogen, hydrogen, chlorine, &c.

Diseases of cattle often afflict men who subsist on them. In 1515 and 1578, nearly all the sheep in France perished by a disease resembling the small pox; and in 1599 the Venetian government to stop a fatal disease among the people, prohibited the sale of meat, butter, or cheese on pain of death. The murrain of cattle has a bubo like the plague, and from 1705 to 1714 it spread among cattle, sheep, and horses all over Europe, 5857 dying in Middlesex, Essex, and Surrey; and Europe lost one million and a half. It affected men who ate the flesh, according to Sauvages, destroying at Nismes the tongue in 24 hours, and Paris was similarly afflicted in 1576. From 1740 to 1750 the cattle, &c. were attacked by disease like the small pox in all parts of Europe, and it was considered as a cause of spreading that disease among the eaters. 300000 died in the Papal states only. Inoculation was tried, and the vaccine pox is considered as a mild species. In 1764, horses, cattle, sheep, dogs, poultry, &c. died in thousands all over Europe. In Holland only 208354.

Vegetables poisonous to man, prove innoxious to other animals, while some which men eat with impunity are fatal to some animals. Parsley kills parrots: prussick acid and bitter almonds, kill dogs and

some birds: opium and arsenick have a diminished effect on dogs.

The poison so freely administered by Italians in the 17th century was called aqua tofana, from the name of the old woman Tofania, who made and sold it in small flat vials which she called manna of St. Nicholas, on one side of which was an image of the saint; she carried on this traffick for half a century and eluded the police, but on being taken, confessed that she had been a party in poisoning 600 people. Numerous persons were implicated by her of all ranks, and many of them were publickly executed. All Italy was thrown into a ferment, and many fled, while some persons of distinction, on conviction, were strangled in prison. It appeared to have been chiefly used by married women who were tired of their husbands. Four or six drops were a fatal dose, but the effect was not sudden and therefore not suspected. It was as clear as water, but the chymists have not agreed about its real composition. A proclamation of the Pope described it as aquafortis distilled into arsenick, and others considered it as a solution of crystallized arsenick. The secret of its preparation was conveyed to Paris where the Marchioness de Brinvaliers poisoned her father and two brothers, and she with many others were executed, and the preparers burnt alive.

The Brunonian system takes its name from Dr. John Brown of Edinburgh, who was born 1736 and died of apoplexy in 1788. He maintained, that disease was chiefly occasioned by debility for want of due excitement; he therefore maintained the utility of increased stimulants, and thus by pampering the appetite and countenancing gluttony, his system for a time was very fashionable.

The mixed and fanciful diet of man is considered as the cause of numerous diseases, from which animals are exempt. Many diseases have abated with changes of national diet, and others are virulent in particular countries, arising from peculiarities. The Hindoos are considered the freest from disease of any part of the human race. The labourers on the African coast, who go from tribe to tribe to perform the manual labour, and whose strength is wonderful, live entirely on plain rice. The Irish, Swiss, and Gascons, the slaves of Europe, feed also on the simplest diet, the former chiefly on potatoes.

Cannabalism has existed among all savage nations. St. Jerome says some British tribes ate human flesh; and the Scots from Galloway killed and ate the English in the reign of Henry I. The Scythians were drinkers of human blood. Columbus found cannibals in America. The aborigines of the Caribbee Islands were cannibals; and some South American tribes, and most of the natives of the South Sea Islands, make it an open practice to eat human flesh: while in some African cities it is openly sold by the pound.

Persons apparently drowned, or in whom animation is suspended, should be laid in warm blankets, with the head raised, and hot bricks, or bottles of hot water, applied to the soles of the feet, hands, stomach, and armpits; the body and limbs being well rubbed with the hands or warm flannels. The lungs should be inflated by blowing into one nostril, while the other and the mouth are stopt, and action given to the stomach as in breathing; and this should be continued first through one nostril, and then through the other, till animation reappears. A clyster made of salt and some mustard, with warm water, should be administered. Hartshorn or salts may also be applied now and then to the nostrils. On recovery some weak cordial should be given, and the person put into a warm bed. In cases of strangulation or apoplexy, bleeding should be immediately adopted, and the legs put in warm water. In cases of intoxication or other poisoning, vomiting should be promoted, an emetick, or the stomach pump, administered. In cases of persons frozen, friction with snow or cold water is to be preferred.

The annual Bills of Mortality were begun during a plague in 1592, and have been continued weekly since 1603. No reliance is to be placed on their discrimination of diseases.

One-fourth of the deaths in London are from consumption, and one-eighth of the deaths arise from drinking spirituous liquors; which has been greatly increased by the legis-

lative measures to increase the consumption for the sake of revenue.

The deaths from small-pox in London, in the twenty years previous to the promulgation of vaccination, were 36189; but in the next twenty years, only 22480. In the same periods, in the Small-Pox Hospital, the numbers were 1867 and 814. The frequency of small-pox after vaccination seems to render it necessary to repeat the vaccination in seven or ten years.

Dr. D'Arcet has proved that clothes infected by persons who have just died of the plague, are purified by being steeped in a chloruret of soda.

Lady Mary Wortley Montague introduced inoculation for the small-pox from Turkey. Her own son had been inoculated with perfect success at Adrianople in 1718. She was allowed to inoculate seven capital convicts, who, on recovery, were pardoned. The practice was adopted by the enlightened, and therefore spreading the disease, it fatally increased among the vulgar and superstitious as interfering with God's providence.

Dr. Jenner made the first experiment in vaccination in May 1796, by transferring the pus from the pustule of a milkmaid, who had caught the cow-pox from the cows, to a healthy child; and publishing the result, the practice spread through the civilized world. The power of the cow-pox as an antidote to small-pox, was a fact familiar to the common people for a century before Jenner's promulgation of it. The tables of mortality have in consequence been so altered, that the average of life which used to be taken 30 and 33, now approximates to 40.

Previous to vaccination, the deaths from small-pox in London were 4000, or about one in five or six. Since, they have been reduced to an average of 1000, but the deaths from small-pox and cases after vaccination have latterly been on the increase.

Infanticide is practised in many countries, but in some of the South Sea islands it is practised systematically by a society called the *Earoweies*, which consists of the heads of families, and are bound to destroy their own children. All the voyagers concur in describing this extraordinary association. Two-thirds of the children born in Otaheite are immediately destroyed.

Edward the Confessor was the first king of England who fancied he could cure the king's evil by touching. This vulgar credulity had, in the age of Charles II., arisen to such a height, that in 14 years, 92107 were touched, and, according to Wiseman, the king's physician, mostly cured!

Caspar Hanser was shut up in a dungeon from four to sixteen. He spoke with difficulty and like a foreigner. He passed his time sitting in a cell 5 feet by 4, and had food and water brought him. At first he could not walk, and had no idea of his power to move or of moving. The light of day oppressed him. All objects disordered him, but musick fixed his attention. At 16 he had no ideas whatever, nor any passions, but on his liberation he learned rapidly.

The dwarf Jeffry Hudson was 3 feet 9, and Count Borowlaski 2 feet 4 inches.

A female who in 1829 was 42 years of age, and resided at Pynacre, near Delph, had, from disease, not eaten any thing since 1818, nor drank any thing since 1820. Total exhaustion was prevented by damp wrappers.

In 1800, a French prisoner at Liverpool exhibited a most extraordinary propensity to devour nauseous diet, particularly cats, of which, in one year, he ate 174, many of them while alive.

An Esquimaux boy, supplied by Captain Parry, ate in one day 10¼ lbs. of solid food, and drank of various liquids 1½ gallon. A man of the same nation ate 10 lbs. of solids, including two candles, and drank 1½ gallon, yet they were only from 4 to 4½ feet high.

During the last great plague in London, one pit was dug in the Charter House, forty feet long, 16 feet wide, and 20 feet deep, and in a fortnight received 1114 bodies. During this dire calamity, there were instances of mothers carrying their own children to these publick graves; and of people delirious, or in despair for the loss of friends, who threw themselves alive into these pits.

The grain on which man chiefly subsists is rice, wheat, maize, barley, oats, and rye.

Such is the force of education, and so much are men what the habits of infancy make them, that in spite of the conceits of the English when Florida was ceded to England by a treaty with Spain in 1769, the whole of the Spanish population left the province and towns except one in a single town and another single in the woods. The same feeling was exemplified by some inhabitants of Nova Zembla, who, on being brought to Denmark, and clothed and fed with every luxury of civilization, so pined for their return to their own inhospitable desert, that some of them died before they could be sent back. Something like this strong principle doubtless governs birds and animals in their return to their native haunts.

Vegetable aliment, as neither distending the vessels, nor loading the system, never interrupts the stronger action of the mind; while the heat, fulness, and weight of animal food, is adverse to its vigorous efforts.
Cullen.

You ask me for what reason Pythagoras abstained from eating the flesh of brutes; for my part, I am astonished to think what appetite first induced man to taste of a dead carcass; or what motive could suggest the notion of nourishing himself with the loathsome flesh of dead animals.
Plutarch.

Nothing can be more shocking or horrid than one of our kitchens sprinkled with blood and abounding with the cries of creatures expiring, or with the limbs of dead animals scattered or hung up here and there. It gives one an image of a giant's den in romance, bestrewed with the scattered heads and mangled limbs of those who were slain by his cruelty. *Pope.*

The common definition of man is false; he is not a reasoning animal. The best you can predicate of him is, that he is an animal capable of reasoning. *Warburton.*

The perception of a woman is as quick as lightning. Her penetration is intuition; almost instinct. By a glance she will draw a deep and just conclusion. Ask her how she formed it, and she cannot answer the question. A philosopher deduces inferences; and his inferences shall be right; but he gets to the head of the stair-case, if I may so say, by slow degrees, mounting step by step. She arrives at the top of the stair-case as well as he; but whether she flew there is more than she knows herself. While she trusts her instinct she is scarcely ever deceived, and she is generally lost when she begins to reason. *Sherlock.*

In the year 1814 was living in the neighbourhood of Highgate, a married woman, aged 35, the whole of whose body, except the face, was exactly divided by a straight line into white and black. The right side, arm, and leg were black, and subject to eruptions; and the left side, arm, and leg altogether white. The neck, with her face, were white. Her children possessed none of her peculiarities.

The Biddenham maids born in 1100, had distinct bodies, &c., but were joined by the hips and shoulders. They lived to be 34; and one dying the other refused to be separated, and died in a short time. They left twenty acres to the poor, still distributed in bread every Easter Sunday.

A more recent case of like kind is that of the Siamese or Chinese youths shown in London. They are joined by a band of cartilage and skin at the stomach, from two inches and a half to four inches long, and eight inches round, are healthy and cheerful, and one in body, inclinations and habits. The band of union is considered as an enlargement of the umbilical cord. There is no nervous connexion through the band, and their sympathy of feelings appears to be the result of habit from infancy to maturity. When both cough, the band is distended like a chronick hernial sac. The abdominal cavities appear to communicate and to have but one peritoneal lining; but the viscera are distinct. At the exact line where one begins to feel the other ceases to feel, and there is no point where both feel. They had a fever together, but not equally great, and both had a cold at the same time. Their evacuations are made together. They go to sleep together and wake together exactly. They play at chess, and differ in ideas about moves—but in habits they are alike, and different in body, though they grew upon one placenta by one umbilical cord.

The late blind Justice Fielding walked in my room for the first time, when he once visited me, and, after speaking a few words, said, "This room is about twenty-two feet long, eighteen wide, and twelve high:" all which he guessed with the greatest accuracy by the ear.—*Darwin.*

Most animals live in amity, but man is the enemy of all; and, unlike those ferocious creatures who kill from motives excited by want and hunger, man kills every thing for sport, aversion, fear, superstition, wantonness, and often for the mere sake of seeing that dead which was living in enjoyment. In consequence, he destroys the natural circle of existence, and reduces countries which he inhabits to deserts, like the once fertile kingdoms of Assyria, Babylonia, Nineveh, Judea, Syria, &c.

About the age of thirty-six the lean man usually becomes fatter, and the fat man leaner. Again, between the years forty-three and fifty, his appetite fails, his complexion fades, and his tongue is apt to be furred upon the least exertion of body or mind. At this period his muscles become flabby, his joints weak, his spirits droop, and his sleep is imperfect and unrefreshing. After suffering under these complaints, a year, or perhaps two, he starts afresh with renewed vigour, and goes on to sixty-one or sixty-two, when a similar change takes place, but with aggravated symptoms. When these grand periods have been successively passed, the gravity of incumbent years is more strongly marked, and he begins to boast of his age. *Dr. Waterhouse.*

The grand climacterick in human life varied between sixty and seventy; and was an astrological period, which depended on the revolutions of Jupiter and Saturn, five of one and two of the other making the climacterick age. By the English law infancy in males extends to twenty-one, and in females to twenty; but the ancients reckoned the period of adolesence to twenty-five.

Total abstinence above seven days is fatal to man; but there are instances of surviving after a longer period. A religious fanatick, in 1789, determined to fast forty days, and died on the sixteenth.

The quantity of pure water which blood in its natural state contains, is very considerable, and makes almost seven-eighths thereof.—*Macquer.*

The Indians destroy their deformed children. Their skins are very thick. They have no beards or hair, except on their heads, for they pluck it out as it appears with split sticks.

The Esquimaux are but four feet high in the north of the American continent; while the Patagonians, in the south, are rather taller than Europeans, and an athletick race. The men are from five feet ten inches to six feet six inches; and measure four feet round the chest, and nearly as much round the pelvis.

Hair has been transplanted from one part of the body to another.

Near-sighted persons are called myopes. Their eye is too convex. A concave glass corrects the defect; just as a convex glass enables us to see nearer by converging the rays.

Among the mammalia, man only has but one thumb.

The atoms composing a man are believed to be changed every forty days, and even the bones in a few months.

The pulse of children is 120 in a minute, at puberty eighty, and at sixty only sixty.

Dr. Lamb infers from the teeth, stomach, and intestines of man, that his natural food is vegetables. Other anatomists have maintained the same opinion, and many philosophers, in all ages, have proved the advantages of vegetable diet in their continued good health and extraordinary longevity. Pope ascribes all the bad passions and diseases of the human race, to their subsisting on the flesh, blood, and miseries of animals. Many thousands in England now live by choice on vegetables; while the Irish, Scotch, and most of the labouring classes do it from necessity, and enjoy health and vigour, except when they indulge in spirituous liquors.

Dr. Lettsom ascribed health and wealth to water, and happiness to small beer, and all diseases and

crimes to the use of spirits: making of the whole a moral thermometer. The Abbe Gallani ascribes all social crimes to animal destruction, thus treachery to angling, and ensnaring; and murder to hunting and shooting; and he asserts "that the man who would kill a sheep, an ox, or any unsuspecting animal, would kill his neighbour but for the law."

Boerhaave describes eight temperaments, the warm, cold, dry, moist, bilious, sanguinous, phlegmatick, and melancholick. The ancients divided men into the airy, the fiery, the phlegmatick, and the earthy; or the sanguinous, the cholerick, the moist, and the melancholick. Reece assigns seven constitutions as connected with disease: the sanguinous, or inflammatory; the phlegmatick, or relaxed; the erysipetalous, or nervous; the hypochondriacal, or spasmodick; the scrofulous: the rheumatick; and the arthritick, or gouty.

Reece in his excellent Medical Guide, enumerates 220 drugs in general use in the relief or cure of diseases. The chief part are derived from the vegetable kingdom; and there are five preparations of steel, three or four of mercury, one of tin, two of sulphur, four of nitre, and twenty or thirty purely chymical, as quinine, morphine, iodine, prussick acid, &c.

As the animal system does not admit of two excitements at the same time, most morbid affections are relieved by new excitements and these abating, the disease abates, and is often cured. This is called sympathy, and the stomach and brain appear to be the common centres of it.

The same medicines, says Reece, have contrary effects primarily and ultimately, and as applied to different functions of the system. Thus opium is at first stimulating, and then sedative. Cayenne and black pepper are inflammatory stimulants of the skin, but remove inflammation of the palate. Turpentine excites the skin, but operates as a sedative in puerperal fever, and on the kidneys. Digatalis diminishes the action of the heart and arteries, and increases that of the absorbents. So with others.

Arsenick and acid solutions of mercury, copper, lead, antimony, &c. are active mineral poisons, for which sulphur and salt of wormwood, or charcoal, are the best antidotes next to the stomach syringe.

Reece relates that a leech of 3 drachms takes 3½ of blood, and as much more escapes after. Those of smaller size in less proportion; so that 24 large leeches take 17 ounces, and 24 small ones but three.

Vinegar boiled with myrrh or camphor and sprinkled in a room, corrects putridity. Smyth's plan was, to heat half a tea cup of vitriolick acid in a vessel of hot sand, and stir into it some powdered nitre, till the room is filled with nitrous vapour. The chlorurets of sodium and calcium have lately been adopted.

The marks used in pharmacy for different weights are as under:—

℔*j*.....a pound or pint.
℥*j*.....an ounce.
℥*ss*.....half an ounce.
℥*j*.....a drachm.
℥*ss*.....half a drachm.
℈*j*.....a scruple.
℈*ss*.....half a scruple.
gr. j.....a grain.

If for manhood a dose is a drachm; in youth it is half; at four it is fifteen grains; at one year five grains; at one month one grain.

A tea spoonful is a drachm; a table spoonful half an ounce; a wine glass two ounces; a tea cup three ounces; a pint is a pound. A drop is a grain or minim; and sixty are a drachm. In prescriptions, *m* stands for minim; *a*, or *ana*, for, of each; *ss* the half; *cong.* a gallon; and *cochl.* a spoonful.

Drugs are weighed below a drachm in three scruples or sixty grains; but above a drachm by avoirdupois weight, and compounded by troy weight. Wine measure is also used.

THE VEGETABLE KINGDOM.

The twenty-four classes of Linnæus are called, according to the number of Stamens—

1. Monandria.
2. Diandria.
3. Triandria.
4. Tetandria.
5. Pentandria.
6. Hexandria.
7. Heptandria.
8. Octandria.
9. Enneandria.
10. Decandria.
11. Dodecandria.
12. Icosandria.
13. Polyandria.
14. Didynamia.
15. Tetradinamia.
16. Monadelphia.
17. Diadelphia.
18. Polyadelphia.
19. Syngenesia.
20. Gynandria.
21. Monesia.
22. Diœcia.
23. Polygamia.
24. Cryptogamia.

The orders are as under, depending on the Pistils—

1. Monogynia.
2. Dygynia.
3. Trigynia.
4. Tetragynia.
5. Pentagynia.
6. Hexagynia.
7. Octagynia.
8. Enneagyina.
9. Decagynia.
10. Dodecagynia.
11. Polygynia.
12. Gymnospermia.
13. Angiospermia.
14. Siliculosa.
15. Siliquosa.
16. Polygamia equalis.
17. Polygamia segregata.
18. Monogamia.
19. Monœcia.
20. Diœcia.
21. Triœcia.
22. Filices.
23. Musci.
24. Hepaticæ.
25. Algæ.
26. Fungi.

The virtues of plants have always been an object of study. Plants are the first decomposers of minerals into their elements, and they also assimilate the constituents of air and water; and, therefore, are nature's chymists. Pharmacy has in some degree superseded them; but till within two or three hundred years, they were medicine as well as food. Their various virtues were seized on by superstition, and for many ages they were connected with the fancies of astrology. The day was divided into planetary hours; and no plant was believed to have its virtue, unless gathered in the hour of its planet, and also at a particular age of the moon.

Botany has always been a favourite study; however, as species and varieties are as numerous as the combination of the elements in various proportions, classification and nomenclature were at all times an object of solicitude. Many attempts, therefore, were made by different botanists, as by Cæsalpinus, Morison, Rivinus, Ray, and Tournefort, who successively adopted most of the distinctions and terms still in use.

But as these were not sufficiently comprehensive and discriminating. Linne, a Swede, or Linnæus, as Latinized, began about the year 1730, to adopt what is called the sexual system, in which he classed them according to the number and situation of the sexual parts, and made the flower and fruit his test of various genera. His first great work was a dictionary of 7300 plants, arranged in classes, orders, and genera, according to this mode of discrimination, improving the old terminology, and giving the trivial of vulgar names.

Van Royen, of Leyden, soon after promulgated another system; Gleditch another system, more simple; and Haller a third: but the system of Linnæus soon prevailed through the civilized world.

His only successful opponents were the Jussieus, who promulgated a natural system, found on the habits and affinities of plants; and this system is now generally adopted in France, and much respected throughout Europe and America.

The terms in botany are very numerous and complicated, and, though generally expressed in Latin, they have clear English synonymes.

25 terms are used in general description.

13 for state of vegetation.

68 divisions of particular descriptions; each subdivided into 400 discriminations, divided among the 68 divisions.

The anatomy and physiology of plants includes half as many more, and the classes and orders about 300 more.

Jussieu divides plants into three divisions: the acotyledons, when the seeds are destitute of lobes; the monocotyledons, with one lobe; and the dicotyledons, with two lobes. The first includes what Linnæus calls cryptogamia; the second is divided into three classes, of four orders, eight orders, and four orders. The dicotyledons are divided into eleven classes, containing seventy-eight orders.

The Linnæan system consists of twenty-four classes, and twenty-six orders, divided into 3000 genera; the

gencra into 50 or 60000 species; and the species into an almost infinite number of varieties. The twenty-four classes depend on the number of stamens, and the orders on the number of pistils.

Botanists record 56000 species of various plants; and 38000 are to be found in catalogues.

The ultimate and proximate principles of all vegetation are oxygen, hydrogen, carbon, and occasionally nitrogen. The proximate principles depend on the proportion of those elements; as when the oxygen is in greater proportion than water, or less, or equal, or when there is nitrogen. This general division indicates acid vegetables, neutral vegetables, inflammable vegetables, and animal product. The first, where the acids prevail, is the acetick acid, the oxalick, citrick, tartarick, benzoick, camphorick, gallick, malick, suberick, succinick, mellitick, saclactick, fungick, and kinick. These acids confer an acidulous character on all vegetables with which they are combined.

When the oxygen and hydrogen are combined in the same proportions as in water, the substance is not acidulous, but consists of sugar, gum, starch, wood, or lignin tannin, and what is called extractive.

When there is an excess of hydrogen, then unctious and inflammable bodies are generated, as fixed oil, volatile oil, resin, caoutchouck, camphor, and wax. In the division containing nitrogen is found vegetable gluten.

Vegetables contain in substance, acids, sugar, gum, mucus, jelly, starch, gluten, and five or six peculiar principles, as tannin, indigo, the bitter and narcotick principle, &c. They also yield oils, wax, resins, &c. In all about thirty-four several products.

Vegetables yield nine several acids: the oxalick in rhubarb; the tartarick in tamarinds, grapes, and mulberries; the citrick in oranges lemons, and onions; the malick in apples, cherries, &c.; the gallick in elm, oak, &c.; the benzoick in balsamick trees; the prussick in laurel leaves, peach blossoms, and bitter kernals; phosphorick in barley, oats, &c.

Sugar consists of oxygen 51, carbon 42, hydrogen 7.

The sugar plant is called the *saccharum officinarum.*

Vegetable substances are fibrous or saccharine, or mucilaginous, when their oxygen or hydrogen are in the same proportion as water. They are oily or resinous, or contain alcohol, when there is an excess of hydrogen; and they are acidulous when there is an excess of oxygen.

The substance of fruit varies as it matures. Green apricots afford no sugar, but more advanced .066, and when ripe .165. The woody fibre is .036, then .025 and .019; the proportion of water also is .89, .84, and .75.

The process of germination changes oxygen gas into carbonick acid, but does not affect the azotick portion of the atmosphere; it is supposed that the seed absorbs the oxygen, and gives out the carbon.

The sap of vegetables consists chiefly of water, with a small portion of potass, some vegetable matter, and carbonate of lime.

The evaporation of vegetables consists of water and minute portions of gummy matter, and carbonate and sulphate of lime.

Vegetation converts the gas of the atmosphere into an equal bulk of carbonick acid gas, without affecting the azote. When no oxygen is present, they either form carbureted nitrogen or carbureted hydrogen, always evolving carbon.

Light is unfavourable to the formation of saccharine matter in vegetation. Their juices are alike, and they are not inflammable when they grow in the dark. Light produces the varieties of their qualities as well as their colours, becoming white in the dark.

Leaves are coloured in the proportion in which acids and alkalies prevail in them; green indicates an excess of alkali. Solar light is the agent by which the carbonick acid in gas is decomposed. The oxygen is thus expelled, and the alkali produces green.

All fruits consist, in various proportions, of water, sugar, potass,

malick acid, mucilage, tannin, gelatin, and a flavouring and colouring principle. The essentials in making wine from them are the sugar, tartarous acid, mucilage, and water. Flavour, colour, and tannin are not essential. The tartarous acid distinguishes wine, and the malick, cider. The sugar, by fermentation, yields the alcohol, with extractive vegetable matter.

The colours of flowers depend on light: and the colouring matter which they yield becomes red when an acid is added to it, and violet, blue, or green, when an alkali is added. Flowers decompose no carbonick acid, but they convert the oxygen in the air into carbonick acid.

The odorous matter of flowers is inflammable, and arises from an essential oil. When growing in the dark their odour is diminished, but restored in the light; and it is strongest in sunny climates.

The sap of plants is mucilaginous, albuminous, and saccharine, in the alburnum; and astringent, or tannin, in the bark. The cambium, between the wood and bark, is a mixture of both.

A retention of the oxygen for want of light, renders plants white; and its excess produces the same effect.

Fleshy leaves absorb oxygen in the night, and give it out in the sunshine. They produce carbonick acid, and also decompose it; and, therefore, do not vitiate the air. In a close vessel they deteriorate and restore the air.

Fruit put into an atmosphere that contains no oxygen, does not ripen; but the ripening process commences when oxygen is supplied. The total weight of fruit in ripening is very little diminished. Heat produces saccharine matter in fruits; and heat without light will mature them.

A chestnut tree grew at Tamworth, which was fifty-two feet round; it was planted in the year 800; and in the reign of Stephen, in 1135, was made a boundary, and called the Great Chestnut Tree. In 1759 it bore nuts which produced young trees.

In a pear shut in a close vessel for seventeen days, the ingredients were much changed: the sugar was doubled; and the gum, water and woody fibre, had decreased. 100 parts of the air contained 13½ of carbonick acid, 7½ of oxygen, and 79 of azote.

There are twenty-one species of the pine: among which the cedar is the largest, and the wild, or Scotch, the most important, producing yellow deal, and trunks sixty or eighty feet high. The silver fir is not less valuable for its quick growth and vast size. The larch is another species of rapid growth.

There are sixty species of the pepper tree.

There are 100 species of heaths, and four natives of this island. In the Highlands they are used in building, for beds, and for malt liquor. They die an orange colour, with a mordant of alum.

There are 216 species of lichen: of which the *orchall* is purple or crimson die; the *omphalodes*, paler, but more lasting; and *islandicus*, used as bread, and in medicine.

Bamboo is, in the torrid zone, and in the East, a production of various most important uses, and grows from fifteen to sixty feet high, being from five to fifteen inches in diameter. It is well known by its hollowness and its joints; it grows rapidly, as much as twenty feet in a few weeks. It flourishes wild in many places; and in China, and other countries, is carefully cultivated in plantations. The soft shoots are cut and eaten like asparagus, and sometimes salted, and ate with rice. The hollow joints afford a liquid, drank by the people; and if not drawn off, a concrete medicinal substance is formed, and much valued. Decoctions of the leaves and bark are also prescribed. Its seeds are eaten as a delicacy; its large joints are used as buckets; and, in many countries, no other wood is used for building houses. Ships are framed out of it, and it furnishes masts and yards. Its leaves make fans. It is also used to make bows, and instead of lead pipes to convey water to great distances. It also forms writing pens, and is woven into baskets, cages, hats, &c.—bruised into pulp it makes fine paper; it is also used for every kind of furniture, and we imitate it in Europe by painting the knots of chairs and tables.

The cotton plant or genus gossypium contains 10 species and is extensively cultivated in warm climates. It belongs to the class monodelphia, and the order polyandria. The seeds are enclosed in a capsule and involved in the filaments called cotton. The plant is raised from seed sown in holes in the spring months. The superfluous plants are pulled up, and the others pruned to the height of four feet. There are annual plants, but the perennial species is cultivated in South America. The seed springs up in a few days in showery weather, and the cluster of plants is weeded when they are a few inches high. The tops are pruned to increase the branches. They yield in seven or eight months, and the crops improve for two or three years, and every four or five years the plants are renewed. The blossoms, a double calyx exteriorly, three cleft, appear in July and August, the pods opening in a few weeks, and the first crop being picked in November and December. The rainy season then produces a second crop, picked in March and April. The pods are then dried in the sun until the seed becomes hard, and the seed is then separated from the cotton by a gin. It is then picked and packed for market. Its great enemy is the caterpillar, called the chenille. An acre of cotton trees, under favourable circumstances, yields 400 lbs. of cotton. The pods are the size of apples, and filled with cotton, surrounding the seeds.

Four only of the species of cotton or gossypium, are important to commerce. The herbaceous is but two feet high, with capsules full of seeds wrapt in cotton wool. The hirsutum, same size, with hairy stalks and leaves, and American. The Barbadoes four to five feet high. The cotton tree, perennial and six or eight feet high.

The mahogany tree is a native of Cuba, Jamaica, &c. and grows from 60 to 100 feet high, with deep green foliage, orange-coloured flowers, and fruit the size of a large egg.

Cork, whose specifick gravity is 240, or $\frac{1}{4}$ that of water, is the bark of a tree called *guercus super*, which flourishes in southern Europe, and northern Asia. It falls from the tree at 12 or 15 years old; but for commerce they are stript for several years successively and then allowed an interval of 2 or 3 years. The young trees are stript only every third year. It is flattened by being piled up in damp places, and loaded with weights, it is then dried over fires for use. As a bad conductor of heat it is used to increase the warmth of apartments, and as the lightest and most elastick of the woods no substance is more generally useful.

The *morus* or mulberry tree has several species. The white, feeds silk worms in China, the leaves sheep, and the branches make firewood. The black produces the best fruit. The bark of the *papyrifero* species is employed in Japan to make paper, and it also makes fine white cloth.

The cinnamon tree is a species of laurel, and is a native of Ceylon. It grows to 20 or 30 feet and its trunk and branches produce the bark.

Indian arrow root is a native plant of South America and cultivated in the West Indies. It is a creeping root, with stalks about two feet high, and the roots pounded and bleached make the starch which is used as nutricious food. It was supposed to be an antidote to the poison of Indian arrows, and hence its odd name. Linnæus calls it *maranta*.

The banian is the sacred tree of the Hindoos. Every branch shoots a new root to the ground, so that they spread indefinitely and afford shady retreats for comfort and religion.

The date in all tropical countries, is one of the most common trees, and grows from 50 to 100 feet, affording food, clothing, &c.

The banana or plantain is the most useful of trees. Its fruit 12 inches long and two thick, serves for bread; the leaves serve for cloth and covering; the root is perennial, but the stalk is annual, and grows to 15 or 20 feet.

The chinchona tree which produces the Peruvian bark flourishes chiefly in the elevated plains of Quito.

Cassada roots are made into bread

in Brazil, and its starch is what we eall *tapioca*.

Sarsaparilla is the root of a Peruvian plant called *smilax*. *Sassafras* is the wood of a tree of the laurel kind.

The great palm or date tree grows in Africa to the height of 60, 80, and 100 feet.

Botanists infer that plants are poisonous when the fruit is a berry, the flower a single petal, and when the fructification consists of five stamens and one pistillum.

The nux vomica, or poison nut, imported in large quantities (as well as opium and coculus indicus) for brewers, is grown on the coast of Coromandel.

The belladona or deadly night shade produces berries like black cherries, which often poison children and eattle.

The potato and yam of the Indians is the arum eupanolatum, the roots of whieh are 5 or 6 lbs.

Nutmegs are the kernel of a fruit like the peach, and when its pulpy covering is removed, is surrounded by a eoat of mace.

The tcha or tea tree flourishes best in a light soil; it is raised from seeds sown in spring and transplanted in rows three or four feet asunder. After three years the leaves are plucked, and the plants yield three year's crops and are then renewed. They resemble myrtles, and their flowers are like the wild white rose. In some provinees they grow six or seven feet high, and in others ten or twelve. They are often made use of for hedge rows, and the leaves gathered for domestick use. The leaves at the extremities are the best, and in spring of bright green. When gathered they are first steamed and then placed on copper, iron, or earthen plates over fires, by which they are shrivelled and curled up. The black teas are then exposed to the sun. The leaves of some other shrubs are so like that, they are often fraudulently mixed. The eommon sorts are sold in China at 4*d*. a pound and the superiour at 2*s*. The additions in foreign countries arise from freight, profit, and government duties, and the profit of the Chinese merchants is from 25 to 50 per cent. The duties in England are cent. per cent. on the price at the company's sales. The English East India Company import above 30 millions of lbs.

Black teas are grown chiefly in the province of Fo-kien. The Chinese prefer it to green tea as a better stomachick; the commonest sort is ealled bouy or bohea. Congou or *congfoo* is a finer kind sold at double the price. *Saot-chong* or souchong is the best kind, and sold at treble. Pekao is another superiour kind, but milder. The tender leaves of young plants are ealled *mastcha* or tea for the emperour.

Green teas are chiefly produced in the province of Kianguan; the difference is believed to arise from the black being dried on iron plates and the green on copper plates. The songlo green teas are so ealled from a mountain of that name, on and around which the shrubs grow. Haysuen or hyson is sold at double the sanglo. Tchu-tcha or gunpowder tea is rolled up by the hand and sold at treble the sanglo. The Chinese keep tea a year; generally in those jars which in Europe are used as chimney ornaments. They infuse it in boiling water and drink it without milk or sugar. They frequently reduce it to fine powder, and put a tea-spoonful into a eup, fill it with boiling water, stir it, and drink it. The Japanese cultivate this shrub as well as the Chinese.

Tea was first introdueed about 1660, and sold at 60*s*. per lb., and hence coveted as a luxury. 30 millions of lbs. are now used in the United Kingdom.

About four millions of lbs. or one fifth of sloe, liquorice, and ash leaves, are alleged to be annually mixed with tea before it is sold to retailers.

The freight of tea from China is equal to 4*d*. per lb. Tea shrubs only bear onee in two or three years.

The allspiee or pimento is 30 feet high and eight or nine inches in diameter.

The average crop of an orange tree is from 6 to 8000. 90000 boxes are imported per annum.

The clove tree grows 40 or 50 feet, bears at 20 and eontinues till 50; they yield from 5 to 30 lbs. per annum.

This spice is cultivated chiefly at Amboyna and three adjacent islands. When possessed by the English the islands yielded about 120000 lbs. per annum, which sold for 20000*l*. The same mercenary despotism on the part of the Dutch prevails here as at Banda.

Opium is the hardened juice of the white poppy and is an article used in Mahomedan countries as a substitute for prohibited wine and spirits, and in England by public brewers to give an intoxicating character to their deleterious compounds. The consumption, in consequence, is enormous, from 50 to 60000 lbs. being consumed in this country per annum. Its price is about 15 or 16*s*. per lb. Superiour opium is also grown in England.

The narcotick or stupifying vegetable principle is made from white poppy, as opium, laudanum, &c. and also made from the milky juice of lettuce, &c.

The betel or pawn, chewed in the East by both sexes, like tobacco, consists of the fruit of the areca palm wrapt in leaves of the betel pepper plant. The fruit grows in clusters, of a reddish colour, and the betel pepper is a species of vine with an ivy leaf; both are cultivated to an immense extent all over India.

Lime is used with the betel nut called *chunan*, and is prepared from calcined shells. This prevents any injury to the stomach. The chewing reddens the saliva and turns the teeth black, but it creates appetite and strengthens the stomach. Women chew it constantly, and the Singalese sleep with it in their mouths. It is the snuff and tobacco of the Hindoos. The quantity imported in some of the British settlements is from 1 to 200000*l*. per annum. Many Hindoos would rather want food than the betel.

The sugar cane succeeds in Louisiana and yields half the sugar used in the Union; an acre producing 9 or 10 cwt. Rice is also a productive crop, an acre, in moist situations, yielding 10 or 12 cwt., and in others 5 to 10. Indian corn yields from 40 to 100 bushels per acre, and wheat from 22 to 50. Tobacco about 1400 cwt. and Cotton when prepared for the market, from 1½ to 2 cwt.

Quercitron is the inner bark of the Quercus Niger or oak, and it produces yellow die. Oak saw-dust produces drabs and shades of brown. Oak apples are a substitute for galls.

Catachusa, a substance much used by tanners, is a hardened vegetable juice or sort of essence of the tanning principle. In analyses, 200 grains are found to contain 100 of tannin, 70 of a peculiar extract, 15 of mucilage, and 15 of earthy matter.

The teasel, used in raising the nap in woollen cloths is the flower of the *dipsacus fullonum*, cultivated in clothing districts. They are fixed on a cylinder revolved against the cloth.

Turners make bowls from sycamore wood. Another species is used for hop-poles. And 25 gallons of the sap of American acer yields 5 lbs of maple sugar.

One peck of seed wheat produces an average crop of two bushels; but by separating and transplanting the roots of a single grain of wheat 500-000 grs. have been produced. France, Poland, &c. produce 5 or 6 to 1, and fertile parts of France 15 to 1. In South America, from 12 to 24 to one.

Two bushels of seed in England, produce 18 of wheat, 4 of barley, and of potatoes 190 bushels in fair crops.

Black pepper is the powder of the fruit, which grows in clusters. White is prepared from it. Long pepper is another species of dried fruit of the pepper tree.

The heart of the aloes tree sells in India for its weight in gold, under the name of tamback.

Under fair management in Ireland, spade-squares of potatoes weigh 19lb. per spade, or 103 barrels per acre, each barrel 252 lbs. or 36000 lbs. to the acre, or 100 lbs. per day on an acre.

285 tons 11 cwt. of turnips were a single crop of turnips on an Irish acre in 1829.

The woods which are heavier than water are Dutch box, Indian cedar, ebony, lignum vitæ, mahogany, heart of oak, pomegranate, vine. Lignum vitæ, is one-third heavier,

pomegranate rather more. Cork one fourth of a pound or 0.24, poplar 0.383, are the lightest woods.

Grew and Malpighi have given the following account of the structure of the apricot and pear, which may serve for other fruit. In the apricot there is a pulpy part, an osseous part, and in the centre the kernel; and the pulp and the stone or osseous part, consist of cellular tissue. The seed is connected with the stone by an umbilical cord. Within the ovulum is an inner tunick filled with celular tissue, and a small tube, the apex of which is the embryo, which when about the fifth of a cheese mite in size, may be distinguished in its parts. The pulp of the pear is made up of very fine cellular tissue, every where furnished with vessels. In the centre are five cells, each containing two seeds, severally attached by an umbilical cord. Throughout the pulpy matter, solid particles are dispersed chiefly about the core, and they serve as centres to little knots of vessels, of which there are fifteen principal ones and ten of them connected with the seeds. These subjects are only to be understood by ocular examination with a moderate microscope, for even the best engravings convey very inadequate notions.

The wood of trees is annually formed by a single ring of vessels which at first surround the pith, and in each following year a new ring of vessels is formed around the preceding; so that the timber consists of a series of annual rings, enclosed in each other. The outer one being whiter and more juicy, and therefore called sap wood, or alburnum.

The seeds of plants are their eggs. A sun flower produces 4000; a poppy 30000, a tobacco plant 3 or 400000; and spleen worth a million. Some, as the sea pink, have but one seed, umbelliferous flowers two, and the spurge and ranunculus three.

The anthers of flowers have nine several forms, and they contain the fecundating dust which impregnates the germ; they have one or more cells and stand on one or more filaments.

The leaves of the mimosa genus collapse either by touch, by night, or by cold; and those of the foot stalk are the most sensitive to touch. The species scandens, spreads to a vast extent from tree to tree, and has pods eight feet long.

The late experiments of Dutrochet lead him to conclude that the *mimosa pudica* possesses the elements of a nervous system. He believes that all the motions are spontaneous and depend on an internal principle, which receives impressions from external agents.

The fibrous tissue of silk is said to be visible in the white mulberry, on which the worms feed.

Wheat and barley grow more in the day than night, and more rapidly from eight in the morning till two o'clock.

Fir contracts in width one 124th, and oak one 140th, by changes in the atmosphere.

Fairy rings are ascribed to expanding fungi, which in a circle of enlarged dimensions exhaust themselves.

Hops entwine to the left and convolvulus to the right. Tendrils bend to the left and back again.

The flower is the part of fructification in plants, and contains, and protects, and ornaments the stamens and pistils.

The seeds of plants consist of three parts: the cotytedon or side lobes, the radicle, and the plumula. The radicle is the germ of the root, and the plumula the stem of the plant. And germination depends on heat, moisture, air, and rest.

Deciduous trees are those whose leaves fall off every year, as opposed to evergreens.

The hedysarum gyrans, according to Linnæus, possesses in its leaves and petioles the power of locomotion, seldom being quiescent; the different leaves all over the plant moving variously up and down, round about, &c. without any external cause whatever.

All plants require a definite degree of heat; and, therefore their growth and heat are mutual tests. The plantain requires from 82° to 73°; and, therefore, will not grow beyond the 27th degree of latitude, or higher

than 1068 yards; or 1000 toises. The sugar cane 82° to 73°, or within latitude 36, or the height of 900 toises. The cotton plant from 82° to 68°, and latitude 34. The olive requires from 66° to 58°, from lat. 36 to 44. The vine requires heat from 62° to 48° and the winter not below 33°. Wheat flourishes at a mean heat of 55°, but when so low as 46°, neither wheat nor barley, nor oats nor rye, come to maturity.

The first green incrustation on rocks and walls, called bissus, species of mosses, leaves a thin stratum of earth for a second crop; and in fine, for wall plants.

Lichens and mosses are the first vegetables that grow on rocks; and in long time they create soil for others by their remains.

Roses came to us from Persia, and into Persia from India. They abound in the countries round the Caspian.

The lotus of the Egyptians is a species of nymphæa, or water lily with a flower like a tulip, white or blue. The roots of the white are eaten like potatoes.

The flower of the khubut, of Sumatra, a mere parasite of climbers, is in breadth three feet; its petals twelve inches; its nectarium would hold six quarts; and its pistils are like cow's horns. It appears as a knob, and expands for three months.

The potato was a native of Chili.

The metallick poisons and mephitick gases which kill animals, also kill vegetables.

The people of Kebba were employed in collecting the fruit of shea trees, from which they prepare the vegetable butter. These trees grow naturally in the woods, and in very great abundance; they resemble the American oak, and the fruit, from which the butter is prepared, is not unlike a Spanish olive. The kernel is enveloped in a sweet pulp, under a thin green rind; and the butter produced from it, besides the advantage of its keeping the whole year without salt, is whiter and firmer, and to my palate, of a richer taste than any butter I ever ate made from cow's milk.—*Park's Travels.*

The cocoa tree supplies the Indians with almost whatever they stand in need of; as bread, water, wine, vinegar, brandy, milk, oil, honey, sugar, needles, clothes, thread, cups, spoons, basins, baskets, paper, masts for ships, sails, cordage, nails, covering for their houses, &c. *Ray.*

The basins made of the leaves of the wild pine will hold a pint and a half or a quart of water; and when they find these pines, they stick their knives in the basis just at the roots, and that lets out the water, which they catch in their hats, as I have done many times myself.

Dampier.

Onions can never be sufficiently recommended; they possess more nourishment than perhaps any other vegetable. It is a well known fact, that a Highlander with a few raw onions in his pocket, and a crust of bread or a bit of cake, can work or travel to an almost incredible extent, for two or three days together, without any other food. The French are aware of this: the soup de l'onion is now universally in use after all violent exertions, as the best of all restoratives. Whoever has tasted onions in Egypt must allow that none can be had better in any part of the world; here they are sweet, in other countries they are nauseous and strong, whereas in the north, and other parts, they are hard of digestion: hence, they cannot in any place be eaten with more satisfaction or less prejudice than in Egypt. They eat them roasted; also made into a soup, which I think one of the best dishes I ever eat.

Hassilquist.

A large onion planted so near a rose-bush as to touch its roots, will greatly increase the odour of its flowers; and the water distilled from such roses is far superior in flavour to other rose-water.

Turnips were introduced into England from Hanover, in the reign of George I., by Viscount Townsend.

In 1816 a plantation of 3000 tea-trees was made in Brazil.

The fig-tree was introduced about 1548
The flowering ash 1710
Lavender 1568
Different mulberries, 1548, 1596, 1629
The Larch 1629
Common laurel 1629
Weeping willow 1692
Laurestina 1596

Barley, in rainy years, degenerates into oats; and oats, in dry seasons, change into barley. These facts, related by Pliny, Galen, and Mathiola, have been confirmed by the experiments of naturalists. *St. Pierre.*

Tobacco was the aboriginal name in St. Domingo; and, with slight variations, is adopted in every European language.

The Brazilian name of tobacco is petum. Its Linnæan name is *nicotiana*, and there are seven species. It would flourish in England, but for the fiscal laws.

Dry reeds, twenty feet high, cover tracts of hundreds of square miles in the Burmean territory.

An elm is full grown in 150 years, and it lives 5 or 600. Ash is full grown in 100, and oak in 200.

A log of mahogany has been brought to England weighing 6⅔ tons.

The quantity of seed used in dibbling is from 1½ to 2 bushels per acre; by broad cast it is 2½ bushels per acre.

Ivy does not kill trees, nor does it grow from their bark.

A sitting room, twelve feet in diameter, was lately shown in London, hollowed from an American walnut tree, eighty feet in the trunk, and 150 feet in the branches.

A chestnut tree on Etna, is 196 feet round close to the ground; and five of its branches resemble great trees.

The Damary oak, near Brentwood, was sixty-eight feet round, and seventeen feet above the ground was twelve feet in diameter.

In the West Indies, the negroes prefer their own preparations of the plantain fruit to bread; and hence the bread-fruit tree, transported at such an expense from the South Sea islands, has been attended with no success in the colonies. *Young.*

In England, the following is the order in which plants display flowers in spring:—

The furze.
The daisy.
The groundsel.
The hellebore.
The snow-drop.
The crocus.
The mezereon.

In *January* the black hellebore and sweet colt's-foot are in flower. In *February* the crocus, the snow-drop, the polyanthus, and the hepatica and daisy. In *March*, the early violet, the primrose, the daffodil, the pile-wort, and the red-dead-nettle. In *April*, the cowslip, the crowfoot, the harebell, the lady's smock, the woodanemone, the dandelion, wood sorrel, and the wild yellow tulip.

Field plants flower as under on the average of seasons:—

In *January*, groundsel, chickweed, hazel, maiden hair, hart's tongue.

In *February*, shepherd's purse, daisy, lungwort.

In *March*, green hellebore, golden saxifrage, fumitory, speedwell, violet, heart's ease, lady's smock.

In *April*, ground ivy, dandelion, stitchwort, black thorn, buttercup, crowfoot, harebell, bugle, and globe flower.

From this time till autumn all vegetation flowers; but in October, November, and December, only the mosses and yew trees; but many flowers blow till Christmas.

Apples ripen in the following order: the codlin, the margaret, the pearmain, the golden rennette, the russet, the nonpareil, the golden pippin. Those used for cider are the red-streak, the royal wilding, whitesour, the underleaf, the John, the hanger, and the gennet.

Culmiferous plants are wheat, *triticum*, which grows best on a stiff or clay soil. Rye, *secale*, grows best in a chalky soil. Barley, *hordeum*, which requires a mellow soil, rather light. Oats, *avena*, which succeeds in the poorest soils.

Leguminous plants are potatoes, *solanum tuberosum*, planted in April. Turnips, *brassica rapa*, sown in June. Pease, *pisum*, sown in February. Beans, *vicia fabia*, sown in February. Carrots, *daucas*, sown in April. Parsnips, *pastinaca*, in autumn. Cabbages, *brassica oleracea*, in March or April. Burnet, *poterium*, sown in March. Beet, *beta*, sown in March.

Herbaceous plants are flax, *linum*, used for linen and oil, grows on a deep sandy loam. Hemp, *cannabis*. Rape, or cole-seed, *brassica napus*.

Woad, *isatis*, used in dying. Hops, *humulus*, used in malt liquor.

Alkanet root is used to colour lip-salve.

Orris, or iris root, is imported from the Levant.

Rhodium is the scented wood of the Chinese rose tree. Yellow Saunders is another eastern scented wood. Cassia-lignum is a scented bark from Ceylon. Cinnamon bark is well known for its fine scent. Clove bark is another of these scented vegetables.

Storax is a fine flavoured gum used in honey-water, &c.; gum Benjamin is another gum, labdanum another; also gum myrrh, dragon's blood, assafœtida, gum Arabick, and tragacanth: all from the east. The balsams of Peru and Tolu are liquid gums.

Otto of roses is the oil which swims at top in the distillation of rose water.

Sarsaparilla is a valuable alterative.

Peruvian and cascarilla bark, and chamomile flowers, are powerful tonicks.

The aromaticks in general use are cinnamon, nutmeg, cloves, orange and lemon peel, pepper, peppermint, spearmint, ginger, cardomon, anise, caraway, coriander, and dill and cumin seeds.

Rhubarb, jalap, pulp of cassia, bitter apple, aloes, senna, henbane, fox glove, and oil of croton seeds, and castor seeds &c. are used as cathartick. Saffron is used as a cordial.

Decoctions of marsh-mallow root, sarsaparilla, barley water, oatmeal, and grit gruel, are used as demulcents.

Sudorificksa re guaiack gum, contrayerva root, and ipecacuanha.

Vegetable diureticks are squills, fox-glove, dandelion, wild carrot seeds, parsley root, buchu leaves, &c.

The senatives are opium, nightshade, lettuces, poppy heads, colchicum, henbane, hemlock, stramonium, and tobacco.

The stimulants are the aromaticks, mustard seed, euphorbium, and foxglove for the kidneys, and ergot of rye for the uterus.

Snuff-taking in England took its rise from the capture of vast quantities of the article in Sir George Rooke's expedition to Spain, in 1702. The prize of the forces was sold in England, and gave rise to a habit now general, and which yields a million a year to the revenue. It is useful only to those disposed to apoplexy, increasing the secretions, and acting like a seton. There are above 120 several sorts in some of the London shops, as at Taylor's, in Fleet Street, &c., consisting of tobacco powder, with various admixtures, scents, &c.

Cudbear is a vegetable substance which grows on rocks, and used in dying purple.

Balsam of Peru is a decoction from the plant *peruiferum*, which grows in Africa and Peru.

Salop is made from the root of the orchis, or fool-stone, a favourite food in eastern countries.

An oak tree in three years grows 2 feet 10½ inches. A larch 3 feet 7½ inches. An elm 8 feet 3 inches. A beech one foot eight inches. A poplar six feet. A willow nine feet three inches.

The pimento or allspice is a species of myrtle in the West Indies, which grows thirty feet high.

Plants are mature for propagation as they are ill nourished.

Terra japonica is the produce of the mimosa catechu.

Liquorice is the extract of the juice of a root cultivated at Pontefract, where it is made into pectoral cakes, and also in Spain and the Levant, and made into cakes, much used by brewers and in pharmacy.

Gall nuts are protuberances on trees created by the puncture of insects, and gallick acid is made from those on the oak.

Gamboge is a concrete vegetable juice, and produced from two trees called *caracapulli*, which grows in Cambodja.

The dendrometer is an instrument for taking the exact contents of standing trees, boughs, &c.

A similitude has been established between feathers and vegetable prickles.

Potatoes afford one-sixth of dry starch.

Pounce is gum sandarach pounded fine.

Raisins are perfectly ripe grapes, dried in the sun, or in ovens.

Bird lime is prepared from the berries of the mistletoe and the middle bark of the holly; it is boiled till it becomes soft.

Mouldiness is a minute vegetation of perfect plants, flowers, &c. of the fungi genus. Dry rot is a variety of mouldiness.

The capsule of the white poppy contains 8000 seeds.

Mum is a German liquor made from malt.

Molasses is the sirup of the cane, which does not crystallize, corresponding with the water of crystallization.

Farina or meal is made from grain, and its nutriment depends on the starch which it contains.

Mace is the second coat of the kernel of the nutmeg.

Manna is a natural product of the ash and larch, and it exudes from those trees in Sicily and Calabria.

Myrrh is a gum resin brought from the Levant and India.

Pitch is inspissated tar, drawn chiefly from pines and from ruins of their ancient forests, in the coal distilled from gas.

Soy is made from the beans of the *dolichos soja*, a native of Japan, pickled and fermented with salt.

The disease in rye, called spur or ergot, affords a black powder, useful in quickening parturition.

The round leaf cornel, has been found useful as a tonick: and the lobella inflata in asthma.

Tincture of chirayita is used as a stomachick; and the essence of buchu leaves for diseases of the bladder.

The charcoal of the areca nut makes a valuable tooth powder.

Extract of lettuce is used to arrest coughs, and as an efficient sedative.

Musk seed is used as a tincture to cure nervous affections.

Colchicum smoked relieves asthma, and as a tincture, relieves rheumatism.

Hedge hyssop, with honey and vinegar, relieves pulmonary affections.

Belladona is a powerful narcotick.

Rhatany root is used as a tonick, and also as tooth powder.

Snuff made from asarabaca, relieves the head and strengthens the sight.

Oil of walnuts and walnut soap are specificks for the removal of pimples and cutaneous blotches.

The sugar cane is a tall reed. The soft parts are eaten by the negroes, and from the hard parts the juices are expressed, which by boiling and evaporation crystallize as sugar.

Chocolate is the solid oil of the cocoa nut.

Gum is pure mucilage, and the juices which when matured are sweet, oily, and farinaceous, were originally mucilaginous.

Lichen or liver-wort yields mucilage, and makes a strong jelly when boiled in water or milk.

MINERALS, METALS, AND CRYSTALS.

Werner divides the primitive rocks as under:—

1. Granite.
2. Gneiss.
3. Mica slate.
4. Clay slate.
5. Primitive limestone.
6. Primitive trap.
7. Serpentine.
8. Porphyry.
9. Transition Sienite.
10. Topaz rock.
11. Quartz rock.
12. Primitive flinty slate.
13. Primitive gypsum.
14. White stone.
15. Clay porphyry.
16. Pearl stone do.
17. Obsidian do.
18. Transition Sienite.
19. Pitch stone.

The transition rocks are—

1. Transition lime stone.
2. Transition trap.
3. Gneiss-wacke.
4. Flinty slate.

Werner teaches that the constituent materials of the primitive rocks formed originally a chymical compost, which deposited the primitive crystallized rocks in a solid state, previous to the formation of vegetables or animals. In the strata which lie on these, their fragments with shells, &c. are found: and these he calls the transition rocks. On these lie the floetz, or secondary rocks. Older and other systems than Werner's had not the advantage of his experience and general science.

Rocks consist of substances differently put together; as by chymical crystallization, considered as natural formation, and therefore primitive, as quartz, felspar, mica, and hornblende, which make up granite, gneiss, sienite, serpentine, porphyry, &c. of eight kinds. The rest are mechanical deposites, formed by the action or solution of water; then there are a class of rocks made up of both these deposites and called transition rocks, which contain the earliest simple petrifactions. The rocks entirely mechanical, consist of sandstones, limestones, gypsum, chalk, iron, stone, &c. and are called secondary.

Werner thinks the quantity of water on the earth was once greater than at present. He infers that transition and secondary rocks are newer than primitive, because the latter basset or appear at the surface only in elevated spots, and the other successively in lower situations. The primitive are chymical formations of silica, alumina, and magnesia, and are of 19 kinds. The transition are of four or five kinds. and partly chymical, partly mechanical, with petrifactions of Zoophites. In the secondary above these, he enumerates twelve kinds, abounding in vegetable and animal petrifactions. The upper strata, formed by water from the rains, and abradings of these, are called alluvial.

The substances which compose granite, are felspar, quartz, and mica. The quartz is gray, and generally transparent, forming the grains of sand. Felspar is of vitrified character but of different colours, and when broken down forms the basis of clay. Mica is a dark gray, often decomposed by the atmosphere, and when worn down, it mixes with the clay of the felspar and the sand of the quartz. Various proportions and circumstances render them the bases of the secondary rocks which appear to be their ruins, and to fill up large original hollows, valleys, or cavities in them.

All minerals are earthy, saline, inflammable, or bad conductors of heat, and metallick, or heavy and coloured.

There are in minerals eight shades of white, nine of gray, six of black, five of blue, twelve of green and yellow, fifteen of red, and eight of brown; besides clear, dark, light or pale of those shades.

Minerals are compact solids, friable or crumbly; or fluid, as mercury or rock oil or tar. Their qualities are—1, Hardness; 2, Tenacity; 3, Frangibility; 4, Flexibility; 5, Adhesion; 6, Unctuosity; 7, Coldness; and 8, Density.

The first class, or earthy minerals, include eight genera; as diamond, zircon, flint, clay, talc, calc, barytes, and strontian. Of flint there are thirty-four species, of clay thirty-two, and of calc twenty.

The second class, or saline minerals, consist of only one genus, with ten or twelve species, as natron, nitre, rock salt, alum, &c.

The third, or inflammable class, includes five genera, as sulphur, bitumens, graphite, charcoal, and resin.

The fourth, or metallick class, includes twenty-one genera, as platina, gold, mercury, silver, copper, iron, lead, tin, bismuth, zinc, antimony, cobalt, nickel, manganese, molybdena, arsenick, &c. &c. Of copper there are seventeen species, of iron fourteen, and lead ten.

All substances on the earth, not of the class of neutral earths, are either acids, or alkalies, or combustibles, solid, fluid, or gaseous.

The Neptunian or Wernerian theory teaches that all the terrestrial formations arise from water; while the Plutonick theory ascribes the whole to fire. Perhaps both may be partly true; water as a constant, and fire as an occasional cause. But if combustion is the sole cause of water, then the Plutonists claim priority.

Mineralogical maps have been contrived by Humboldt; in which limestone is represented by straight lines, salt by straight declining lines, porphyry by waved lines, and granite by irregular points.

Granite lies under all other rocks; and when it forms high mountains, the other rocks and strata are piled against it, so that it is constantly the undermost.

Immediately above granite lies gneiss, or granite in strata; then mica-slate, and above that clay-slate; and mingled with these last is primary limestone, trap, and serpentine. These primary rocks consist of crystals.

Secondary rocks, consisting of gray-wacke and sandstone, appear to be depositions, and lie more horizontally; and in mountains of primary formation they terminate at lower levels. Gneiss itself is considered as debris of granite, which has settled on the granite, and the slates upon it, and less inclined.

The newer secondary rocks lying more horizontally on the older, are at lower levels; so that the older rocks basset, or display their edges higher and higher on the sides of a granite mountain.

Sienite is a middle rock between granite and porphyry, composed of felspar and hornblende, or quartz and black mica.

When large crystals of felspar appear in granites, they are called porphyritick. In Cornish granites, the felspar is white. In the Scotch, reddish brown.

Silica, the substance of sand, sandstone, flint, granite, quartz, &c. has a specifick gravity of 2.66. It has been imagined to consist of oxygen and a metallick base.

There are five species of quartz: amethyst, rock crystal, milk quartz, common quartz, and praise.

Felspar is composed of lamina or plates. Its constituents are silex and alumina, with some potash. It abounds in granite, gneiss, sienite, and porphyry.

Serpentine is so called from its variegated colours, generally green. It consists of 32 silica, 37¼ magnesia, ½ alumina, 10½ lime, with iron and carbonick acid 15.

Curved gneiss proves that it once was fluid. It is in slaty layers or plates formed of felspar, quartz, and mica, separated by thin layers of mica, and it contains in its veins all the metals.

Porphyry is stone with a compact base, intermixed with crystals. The base is of the trap kind, and the crystals felspar or quartz.

Hornblende is an extensive clay mineral, forming slates and part of primitive rocks, of a greenish black colour.

Jasper is found in veins of primitive rocks, or in nests of porphyry.

Flint contains 98 silica, 0.5 lime, 0.25 alumina, and 0.25 oxide of iron. It is found between beds of calcareous rocks, but its origin is a mystery.

Gray-wacke is a coarse kind of slate, or grains of sand in a basis of slate.

Gypsum is sulphate of lime, supposed to be formed by the decomposition of iron pyrites, the acid from which has combined on the spot with lime.

Chalk is found only in the north of Europe, and chiefly in the British Islands. It is imported into eastern countries as a rarity and curiosity.

Alabaster differs from marble in containing sulphurick acid. There are three species, one of which is white, shining, and semi-transparent.

Pudding stone is rounded pebbles imbedded in cement, capable of being fashioned and polished.

Stalactitæ, or stalactites, are crystalline spar, which ooze from the earth over the tops of caverns, like icicles, often reaching the bottom, and forming solid sparry columns; and proving how similar oozings cement all lower strata by the gradual precipitation of cement from upper strata.

Portland stone is coarse grit, cemented with earthy spar.

Potter's clay is 43½ silica, 33 alumina, 3½ lime, 18 water, and 1 oxyde of iron.

Emery is a mineral of 4 specifick

gravities, containing 86 alumina, 3 silica, and 4 iron.

Soda is found in mineral seams, also in beds near Alexandria. The manufacturing chymists make it from common salt.

There are two substances called marl, one earthy and the other a stratum, but not hard. The earthy is used as manure, as well as the other found in beds, in limestone and coal formations.

In mining, from 8 lb. to 21 lb. of powder is employed for every cubick foot above it, according to the density of the soil.

Salt in Cheshire is produced from salt pits, and chiefly from salt springs. The district is in the line which joins the Severn, the Dee, and the Mersey, and doubtless once consisted of lakes flooded at every tide, which, drying at certain seasons and at low tides, deposited beds of salt from Droitwich in Worcestershire, through Nantwich, Middlewich, and Northwich to the Mersey; brine springs flowing over beds of salt, or rock salt being found at different places in the entire line.

Rock salt is found in Cheshire at the depth of from 28 to 50 yards, and the beds are from 1 yard to 40 yards thick, separated by clay or flag stones; the colour is reddish, and it is so hard as to require to be blasted with gunpowder. The largest mine is 330 feet deep and 20 feet high, supported by pillars of the salt.

The Droitwich springs contain one quarter of their weight in salt. It is said, that a stream of salt water runs 250 feet below the surface, over which is 140 feet of gypsum, the boring of which produces the spring.

There are extensive beds of salt at Lake Inder in Asiatick Russia, lat. 48° 30′, long. 69°.

Salt springs and others from inflammable gas, are found in China, in long. 101° 29′, lat. 29°, near Thibet. They bore the well through the rocks, and prepare the salt by firing the gas of others, so that one heats 300 kettles by gas fire.

The sea, if desiccated, would afford a bed of salt 500 feet thick, 100 for every mile.

Peat consists of black spongy earth and decayed vegetables.

Coal beds become unproductive in the vicinity of porphyry or granite. Each particular stratum preserves its own parallelism though often interrupted by dikes and slips which are filled up with clay, sand, and rounded stones, evidently swept into them by water, and some of them contain basalt. Coal appears to have been used by the Saxons, and some believe by the Britons. So long since as the revolution, London consumed 300000 chaldrons per annum.

Strata of coal are not continuous, but divided both horizontally and perpendicularly by dikes or chasms, by slips, hitches, and troubles, apparently produced by the drying of the strata and by the sinking of the rocks beneath.

A cubick foot of coal weighs from 75 to 80 lbs., and 27 equal to a ton per cubick yard, or 4840 tons to an acre, of a yard thick, and in proportion.

Carbureted hydrogen explodes in coal mines when there is one of gas to six or twelve of air, but at one to fifteen it merely lengthens the flame of a candle. Carbonick acid gas also abounds, but lying on the ground and first extinguishing candles, it is seldom fatal.

The coal mines, which in Staffordshire have been burning for 200 years, consist of pyrites, subject to spontaneous combustion. Water will not extinguish them, because when drawn off or absorbed, the pyrites burn more than before.

Newcastle obtained the first charter to dig coals in 1239, and in 1281 the export was considerable. In 1825, the produce was three millions of tons, and employed 70,000 persons, with a capital of two or three millions.

The coal fields of England run from the Tay to Bristol, in length 300 miles, and from 20 to 120 broad. They lie in the floetz or new secondary rocks, and in the upper series or newest floetz, but chiefly in the former.

The coal strata or independent coal formation consists of sandstone, white and gray, or reddish, slate-clay, fire-clay, iron stone, and green stone.

Unlike the primary and secondary

rocks, they are generally horizontal or nearly so. They vary from three degrees to twelve, or from one to four feet in twenty.

At Newcastle, the bed two yards thick is 150 yards deep, and though there are eight beds above this, the thickest is but one foot, and the whole are but five feet. Thirty-three yards lower a bed of a yard presents itself, and fifty yards lower one of thirty-nine inches. Nine yards lower another of thirty-eight inches, and eleven yards lower, or 270 yards, a bed of two yards. Altogether there are sixteen beds in 270 yards depth, equal to eleven yards. The intervening strata are sandstone or slate clay, in one place but four feet, but in another 120. Hence, if coal beds are decayed forests, covered by the sea there must have been sixteen inundations, and other beds are found lower to the depth of 1000 yards, while Scotland presents twenty-four beds in 233 yards. These beds then afford evidence of twenty-four revolutions of the perihelion, or confer an age on the world in this coal-forming period of 24+20900, or 501600 years. Through the whole of the strata, animal and vegetable remains are found. In the mean time the globe must have been enlarged, if forests grew 1000 yards below the present level.

In Staffordshire there are but thirteen beds, but the depth is but 107 yards, and there are twenty-three yards of the 107. The first occurs at sixteen yards of ten feet thickness, and three others of twenty-three feet, separated only by a few inches of bituminous stone. The lowest at 105 yards is seven feet and a half. The intervening strata are sandstone and clay, just as in other coal beds.

Newcastle exports from 5 to 600000 chaldrons of coals of 53 cwt. each, and nearly as much is shipped from Sunderland, Teignmouth, Wearmouth, &c. The beds are calculated to maintain this consumption for another 300 years, having maintained it to half the extent for an equal past period.

Duties on coals in the port of London are 9s. 4d. per chaldron, and to other ports 6s. The London duties are from 560*l.* to 600000*l.* per annum. 28000 tons, or 31 million cubick yards of fresh coals are raised per annum.

Newcastle coals cost, at the pit's mouth, per chaldron of 27 cwt., or 12 bushels, 14s. for Wall's End, and 12s. for Eden Main. The charges for conveying to the ship, loading, &c., are 4s. 9¾d.; the freight to London 11s.; the government duty 6s.; the city dues 4s. 9½d.; and the charges of unloading, measuring, and delivering at the cellars of consumers, are 13s. 7d.; making 2l. 12s. 11¼d. per chaldron.

Newcastle ships a million and a quarter chaldrons; Sunderland three quarters of a million; Wales about 180000; Whitehaven 200000. Newcastle and Sunderland also export about 120000 chaldrons

Every family in England and Wales is considered as using, on the average, six chaldrons of coals, which makes the annual consumption about fourteen million chaldrons.

The steam engines and gas manufactories consume about six millions of tons more, making a total consumption of about twenty-two millions of chaldrons or tons. The weight of the wholesale chaldron is, however, 28 cwt., and, therefore, the gross consumption will not be overrated at twenty-five millions of tons.

The apprehension of failure is a delusion: some of the most extensive coal districts being little worked, owing to the impolitic Newcastle monopoly. In Yorkshire there are exhaustless beds, which are sold at 4s. or 5s. per ton.

As coals are sold by measure, and small coals measure more than large ones, so the large masses drawn from pits near Newcastle are broken up by all the dealers before they reach the consumers. The difference is twenty, thirty, and fifty per cent.; and hence the merchants will receive no small coals, and they are obliged to be burned on the spot to destroy them.

The Netherlands are rich in coals, and vast quantities are produced in the tracts between the low countries and the present French frontiers.

At Barbadoes, asphaltum dug in the island is used instead of coal. In Trinidad there is a pitch lake on a

cape, and three miles round, and of uncertain depth. It lies in furrows or chasms constantly changing, but is so hard as to require to be broken with an axe. The district near consists of cinders and burned earth, and for a large extent appears to be of volcanick origin. By analysis, the asphaltum appears to consist of stone saturated with pitch. It is very inflammable, and is considered as a result of the changes from naphtha and petroleum, into tar and pitch by successive decompositions.

Magnesia is obtained from magnesian limestone with the bittern of salt manufactories. The muriatick acid of the salt unites with the lime, and affords the magnesia. Exposed to the air it absorbs, in time, carbonick acid; becoming lime again, and unfit for medicine. It has been found pure in New Jersey.

Magnesian limestone effervesces little in acids, and it renders dilute nitrick acid milky. It contains about 20 magnesia, 30 lime, 48 carbonick acid, and one of clay and oxyde of iron.

The smell in lime-slacking arises from the ascent of part of the lime, with the aqueous vapour.

Limestone, marble, and chalk, by burning, form lime, which does not unite with alkalies or oxygen, and only with sulphur and phosphorus among combustibles and their and other acids. In becoming mild, it renders insoluble matter soluble, and hence its use as a manure under due caution.

Puzzolana is decomposed lava. Tarras is decomposed basalt, mixed with two parts of slacked lime.

In 3½ years mortar regains its definite proportion as carbonate of lime, or 63 per cent., from the carbonick acid gas in the atmosphere.

One bushel of coals makes four or five of lime, and magnesian limestone less; while this last loses half its weight.

In Bundelcund there are diamond mines, in a range of hills near Pannah. One of them produced the largest known diamond, and they are still moderately productive. They lie six or seven hundred miles from Calcutta.

The two largest diamonds in Europe are that belonging to the Emperor of Russia, which weighs 195 carats, or 1⅓ oz. troy; 90000*l.* was given for it, and an annuity to the merchant of 4000*l.* per annum. The other is the Pitt diamond, which weighs but 136 carets, for which, in 1720, 100000*l.* was paid by the court of France. Diamonds are imitated by combining one half red or white lead, with silex, potash, and some borax or arsenick.

Emeralds are green, and prismatick or rhomboidal. The beryl is an inferior species. The prismatick, is one-third silica, and one-fifth alumina; and the latter, or best, two-thirds silica to one-sixth alumina.

The oriental garnet is red, and the common garnet brown or green, of the size of a pea or larger. They are found in primitive rocks.

The hardness of precious stones is in the following order: Diamond, ruby, sapphire, topaz, hyacinth, emerald, garnet, amethyst, agate, turquoise, and opal.

Amber is a mineral substance, white or yellow. Its oil is used in *eau de luce*. When rubbed it becomes negatively electrical, like sealing-wax. It is a vegetable gum; but some have considered it as honey converted into bitumen. Some pieces contain insects and leaves of unknown species, of the age of organick remains.

From 150 to 200 tons of amber are found annually in the sand on the shore between Pillau and Polungen. It is also there in beds of pit coal.

Pits of fuller's earth are found in Bedfordshire. There lie over the stratum several strata of red sand, six yards thick; then a stratum of sandstone seven or eight yards; then other sands; then the fuller's earth. Below it is white free-stone, and below that sand again.

Blasting is used for the hardest limestones, green stone, basalt, sienite, gneiss, and granite.

The Earths are silica, lime, alumina, magnesia, with barytes, strontites, glucina, zirconia, yttria, and thorina.

Soils are divided into clay, clayey

loams, rich loams, sandy loams, sand, peat-earth, chalk and gravel; and in grass each sustains particular kinds best; in the rotation of crops each requires different succession, and demands different kinds of manure and treatment.

Soils consist of silica, lime, alumina, magnesia, oxydes of iron, and animal and vegetable remains; and on the union depends fertility, for too great an excess of one renders soil barren. Bulbous and tap roots grow where sand predominates; but fibrous roots require more clay and firm substances.

Metals are considered as undecomposable substances, yet those that are inflammable must evidently contain hydrogen. They are twenty-three in number as under:—

	Specifick gravity.
Platinum	23
Gold	19.376
Silver	10.5
Mercury	13.57
Palladium	11.87
Rhodium	11.
Copper	8.8
Iron	7.7
Nickel	8.8
Tin	7.3
Lead	11.4
Zinc	7.19
Bismuth	9.85
Antimony	6.712
Tellurium	6.115
Arsenick	8.31
Cobalt	7.7
Manganese	8.013
Cromium	5.9
Uranium	9.
Molybdenum	8.611
Tungsten	17.6
Titanium	4.2

Metallick veins in rocks have the appearance of being exudations from the substance of the rock; a brown vein proves the presence of iron, and sometimes of tin; straw colour of lead; green of copper. Silver is only discovered among certain classes of limestone.

When the dislocations or fractures of strata are filled with stones or earth, and the separations are wide, they are called *faults* or *dykes;* and when filled with metallick ores they are called veins. In these last are found the ores of metals separated from the rocks by gypsous spar, quartz, clay, or earth, called the matrix or rider of the ore. When the veins are not filled up with matrix, the ores are crystallized round the cavity. The ore also contains sulphur, arsenick, and earthy substances, besides different metals, which are separated by washing, roasting, reducing, assaying, &c.

Ores are always found as alloys, sulphurets, oxydes, or salts. Gold, platinum, and columbium are found only as alloys. Silver, mercury, copper, iron, antimony, arsenick, and cobalt, in the four states. Lead and zinc, in the three last. Others various, in two or three states; and tungsten, uranium, titanium, chromium, and tantalium, only as oxydes.

Metals have five degrees of lustre—*splendent*, *shining*, *glistening*, *glimmering*, *dull*.

Gold is yellow, copper red, iron gray, lead blue, and cobalt and manganese gray; all the rest are white.

Iron, manganese, tungsten, and palladium are the hardest of the metals; the next in hardness platinum and nickel; the next are copper and silver; and the next cobalt, antimony, zinc, tin, and gold.

In the earliest ages no metals were used but those found pure, as gold, silver and copper. The smelting of ores was a comparatively late invention, and ascribed both to observations on volcanoes and to the burning of forests.

Lodes and mines are by many supposed to have been passes of streams of water choaked up; and in most mines such streams still remain. In Cornwall they run from east to west; but in other countries they often run from north to south. The tests of a probable mine are mineral waters, trees or grass discoloured, metallick ore or sand, and the products of boring.

One million ounces of gold are supposed to be produced annually.

The obtaining of gold in mining countries costs about fifteen times as much as silver; and this cost affects the future price in the market in that proportion.

Gold is so malleable that it may be beaten into leaves of which

280000 would be but an inch thick, and so tenacious that wire but the thirteenth of an inch in diameter will suspend 150 lbs. Gold is too soft to be used pure, and to harden it it is alloyed with copper or silver. In its pure state, gold bullion is considered as twenty-four carats, and then it is sold by the number of carats of pure gold, and gold of twenty-two carats is that used in our coin; two parts of which are copper. Gold plate is about eighteen carats or one-fourth copper.

The hundred-thousanth part of a grain of gold may be seen by the naked eye, and a cube of gold whose side is but the hundreth of an inch, has 2433 million of visible parts. A cylinder of silver covered with gold leaf may be drawn out 350 miles long, and yet the gold will cover it.

Gold leaf can be reduced to the 300 thousandth part of an inch, and gilding to the ten millionth. Silver leaf to the 170 thousandth. The specifick gravities are 193 to 195.

Kelly's Cambist.

Lace gilding is the millionth of an inch thick; gold leaf the 200 thousandth. Platina wire may be the 50000th of an inch. 500 inches of gold wire has been drawn from a grain. Tin-foil is the one thousandth of an inch; that is, 200 gold leaves are only equal in thickness to one of tin-foil.

A mass of 25 lbs. of pure gold has been found in Siberia.

Silver leaf breaks at the 160000th part of an inch, or three times the thickness of gold leaf. It tarnishes from sulphur, and dissolves in sulphurick and nitrick acid.

Silver can be beat into plates, of which 110000 make an inch, and drawn into wire, of which the thirteenth of an inch will sustain 137 lbs.

The weight of an ingot of silver is from 50 to 60 lbs. and the weight of an ingot of gold is 15 lbs. troy.

The quick-silver mines in Carniola are the most productive in Europe, and have been explored 900 feet deep. The mercury is found in clay, stones, and it often issues from the rocks spontaneously. The mines yield 12000 quintals, or 1200 tons weight per annum, and yield a million of florins to the imperial revenue; and half the quantity of native cinnabar. Till within fifty years all the steel used in English manufactures was made in Carniola from the iron with which it also abounds. Trieste is its port.

Mercury is found in combination with sulphur, as cinnabar in Austria and Mexico, and sometimes native.

The platinum of commerce is found in the Spanish mines in South America in grains, which appear to be a compound of eight several metals: as palladium, rhodium, irydium, osmium, &c. A platinum wire of the thirteenth of an inch will suspend 274 lbs.

Iron, as well as glass, was accidentally discovered by a fire made of iron stone in one case; and of lumps of natron and silicious matter in the case of glass. The Greeks ascribe the discovery of iron to themselves, and referred glass to the Phœnicians, but Moses relates that iron was wrought by Tubal-Cain, Noah's brother.

The iron stone is known to practical men by its weight and other characteristicks. But no iron is visible in the fracture. It is as easy to believe that it is then formed from primitive atoms, as to conceive that it is an oxyde of what never existed in a native state to be oxydized.

An iron wire the thirteenth of an inch in diameter suspends 549 lbs. The air oxydates it in the red or yellow powder called rust. It burns brilliantly in oxygen gas. The black oxyde of iron contains 79 iron and 21 oxygen. The red oxyde or peroxyde is obtained by putting red hot iron filings in an open vessel and agitating them till they produce the common red paint. It is the oxyde which produces the red colour of bricks and clays. It is 69 iron and 31 oxygen. Carbonate of iron, or iron and carbon, is black lead, or 19 parts of carbon and one of iron. Phosphuret of iron is called syderum.

The ores of iron, or iron stone, are considered as mixture of clay with oxyde of iron. They are mixed with charcoal and lime in a large furnace, and the oxygen combines with the charcoal, and the clay with the lime, by which the grains of iron are sepa-

rated and melted, so as to run out in a fluid state at the bottom of the furnace. It is white, gray, or black, and when cool has a density of 7.5.

This cast iron is then converted into bar or wrought iron by being melted in charcoal, and ashes with scoria of iron, and by repeated forging it becomes malleable.

Bar iron is then converted into *steel* by being stewed while red hot with charcoal for three to seven days. It is then cast in ingots, and its specifick gravity becomes 7.8, and in chymical language it is subcarburet of iron.

Cast iron is a supercarburet of iron; and wrought or soft iron is the simple metal divested of foreign materials.

These several conversions employ 69 thousand men in the largest and most imposing manufactories. The mines which afford iron stone employ great numbers. It is then roasted or burned; afterwards exposed to great heat in immense furnaces excited by vast bellows wrought by steam engines. The casting is then a curious process into pigs or ingots, or utensils of all kinds. The puddling, forging, and tilting, then call for machinery of gigantick size. Then follows the steel conversion, and finally the cutler.

The best steel used in British manufactures is made from Swedish iron, of which there is used about 10000 tons annually. One of the principal establishments in England for converting Swedish iron into steel, is that of Nayler and Sanderson, of Sheffield. They make most of the fine steel which is made into cutlery in that town at the celebrated manufactories of Rodgers, Picksley, Champion, and others.

Iron furnaces among the Romans were unprovided with bellows, but were placed on eminences with the grate in the direction of prevailing winds. Blasting bellows are now the most colossal structures in the entire range of manufactories, some of them being of such sizes as to be wrought by a steam engine of eighty horse power, and their roar on entering the fire may often be heard for miles. The object of all such contrivances is to keep up a supply of oxygen gas, which being fixed by the hydrogen evolved by the fuel, its motion is transferred to the ore which is to be swelled and de-oxydated, while the lime which is mixed with the ore melts and combines with the argillaceous substance in which the iron is imbedded. Experiments have lately been made to add to the power of the air driven through the bellows, by previously heating it. In the largest class of blasting bellows the blowing cylinder is eight feet in diameter, and it discharges twenty-four cylinders per minute, or nearly 12000 cubick feet of air with the force of 3 lbs. to the square inch; but, in general, one engine operates on different furnaces with 3 or 4000 cubick feet of air per minute. A single furnace thus smelts from forty to fifty tons of pig iron daily.

In twenty-four years the imports of bar iron have varied from 3200 tons in 1806, to 15000 in 1828, while the re-exports in 1806 were 5000 tons, and in 1828, 3000 tons. The market prices were, in 1806, from 15*l.* 10*s.* to 18*l.* 10*s.*; and in 1828, 13*l.* 10*s.* to 18*l.* 10*s.* The duty is 30*s.* or from Canada, 20*s.*

There are about 700000 tons of iron made per annum by nearly 300 furnaces, of which ninety are in South Wales and 95 in Staffordshire, &c.

In 1740, the quantity was but 17000 tons from fifty-nine furnaces. The imports from Sweden are 15000 tons.

The quantity of iron converted in the United Kingdom by 278 furnaces, was, in 1828, about 735000 tons of pig iron, which yield two-thirds of wrought iron, or about 545000 tons, of which 150000 are exported in bars, hardware, and arms. 50000 tons of old iron are also manufactured.

Of the quantity of iron, South Wales produces 279½ thousand tons, Staffordshire 219½, Shropshire 81¼, Scotland 37¾, Yorkshire 33, Derbyshire 22½, and North Wales 25. The quantity has increased 100000 tons per annum.

50000 tons were exported in 1814, at a declared value of 1143357*l.* and 100000 tons in 1828, at a declared value of *only* 1220820*l.*

In 1740, according to Marshall, the pig iron was but 17000 tons; in

1788, it was 68000; in 1796, 125000; and in 1828, five times more.

The United States, in 1828, took 4822 tons of cutlery, being above half our exports.

Colnbrook dale is a winding glen between two hills, about eight miles long and two broad. It supplies iron ore, coal, and lime, to some of the largest smelting and casting establishments in the kingdom. Iron stone china is also made here, and it has been for many years a seat of astonishing production.

The steel and iron factories at Pittsburgh consume 11000 tons per annum; 3500 in castings, and 7500 in rolling. 18 tons of nails are made daily, and there are seven steam engine factories. The iron is made at Juniata.

All the iron smelted from ore in England, and used or exported, is equal to a cube of forty-six yards; and all the materials extracted to make it, and the iron, would make a solid of 162 yards, or the 1500th of a cubick mile, consequently iron miners would be 1500 years in disembowelling a cubick mile of iron stone, lime, and coal, taking the whole as forty times the bulk of the produced iron.

Daunemora is the largest iron mine in Sweden, and Fahlun is the greatest copper mine in that kingdom of rich mines. The ore forms a large vein in a hill, thirty miles from Upsal. It is wrought to a considerable depth by blasting, and the ore affords 50 per cent of cast iron. It is the iron which is converted into steel at Sheffield, and known by its mark of three balls. Its superiority in England is ascribed to its being smelted with wood instead of coke.

It is ascertained that in regard to the blasting bellows in iron works, that hot air passed through the bellows produces thirty-six tons of iron No. 1, in eleven castings, and that cold air produces but thirty-three tons, chiefly of No. 3. The effect appears to be occasioned by the pre-existing power of the heated air, by which the power of the bellows is augmented.

Copper wire the thirteenth of an inch will sustain 302 lbs. Copper pyrites is a native sulphuret of copper. Silver coin contains one thirteenth of copper.

The great Swedish copper mine at Fahlun yields from the ore but one and a half per cent., and has the appearance, says Thomson, of iron pyrites. It is a vast open cone. It has been worked for 5 or 600 years, and when most productive yielded 8 million lbs.

Parys mountain in Anglesea has yielded from 40 to 800000 tons of ore annually, of which 25 per cent. was sulphur, and from 25 to 1½ per cent. copper. In the stratum over the ore is sulphate of lead, which yields 40 per cent. of lead and 57 ounces of silver for every ton of lead. There are two mines, the Mona and Parys.

Cornwall is the most productive and celebrated of the mining districts of Great Britain. The mines run from St. Austle westerly to St. Agnes, by Redruth to St. Ive's Bay, and on the surface it is a dreary district. The country also abounds in granite, with various proportions of felspar, quartz, and mica. The mines are tin, copper, and lead; and in strata of schistus and granite. The tin is calciform and glass-like, the matrix argil or silex; and the world has been supplied with this metal from hence since the days of the Phœnicians. Copper, now so important a product, was not produced here till the Revolution. The ancient workings on the eastern coast are exhausted, and the present produce is 25000 blocks, worth 10*l.* or 12*l.* each. Tin oar is the heaviest, but easily melted. The Huelor mine is 840 feet deep and spreads 1¼ miles, employing 1300 people. All the mines employ sixty steam engines, some 1000 horse power; and their average duty is 34. 85 millions of pounds one foot high, per bushel. The Poldice mine yields a thousand blocks; but as copper follows the tin, many of them now are copper mines, from ore of pyrites and sulphur, all among granite, and inclined from 60° to 76°. The entire produce is about 4700 tons, worth now but 7*l.* or 8*l.* Crennis, Huel, Alfred, and St. George's, are the most productive at present. Near Helstone there are two lead mines, and at Endillion one of antimony. Gold and silver are also found, as well as bismuth, asbestos, and lapis

calaminaris. The Tintagel slate pit is 300 yards long, 100 broad, and 80 deep. Moor stone, or granite, slates, and china stone, or steatites, for fine pottery, are also sources of wealth, and the whole employ from 12 to 15000 people of all ages.

In Cornwall there are about fifty copper mines, thirty tin mines, twenty copper and tin, five silver and lead, three cobalt and antimony, and two of manganese. Tin and copper exist in veins and fissures called lodes, one side granite and the other clay, in lines from east to west, occasionally in layers. It is cast into blocks from 3 to 4 cwt.; and then assayed at Cornwall, Lestwythiel, Truro, Helston, or Penzance. The produce per annum is about 25000 blocks, averaging 3 cwt.

A lead wire, the thirteenth of an inch sustains 28 lbs.

The Stannaries are the tin and copper mines of Cornwall.

The copper mines of England, chiefly in Cornwall, Anglesea, and Glamorganshire, yield about 16000 tons.

The lead mines in Derbyshire, Cumberland, &c. yield about 15000 tons per annum.

A tin wire the thirteenth of an inch sustains but 34.7 lbs.

Manganese has so great an aptitude to combine with oxygen, that, on being exposed to the air it absorbs so much as to fall into powder; if thrown into water it decomposes, the water becomes green, and is found to have absorbed 0.15 of oxygen. If this be exposed to the air it turns brown, and is found to contain one-fourth oxygen. In a native state the oxyde contains four-tenths. From this cause the native black oxyde is used to obtain oxygen gas, which may be expelled by heat. The red oxyde of iron contains 0.41 of oxygen; arsenick acid one half; and red chromium double.

Zinc wire sustains 110 lbs. and if heated above boiling water, it may be rolled very thin, and drawn into wire. At a red heat it inflames, and disperses in flakes. It amalgamates with most of the metals, making a sort of paste.

Galena is the native sulphuret of lead, and often contains antimony, silver, and zinc.

Selenium is a new metal obtained by Berzelius from the pyrites of Fahlun. Its specifick gravity is 4.32, and it is a deep brown.

Cadimum is another metal in union with zinc, with a specifick gravity of 8.604, and of a gray colour.

Wodanium is gray, and 11.47.

These are new metals and very different from the factitious, evanescent globules procured by Davy from galvanick combination with alkalies. They make the number thirty.

Magnetick pyrites is a sulphuret of iron, 63 iron and 37 sulphur, and called loadstone. Super-sulphuret of iron is the common iron pyrites, 47 iron and 53 sulphur.

Gun metal is 12 lbs. of tin and 100 of copper.

Bath metal is 2 lb. of brass and nine ounces of zinc.

Quartz is a sparkling stone, very abundant, from the common pebble to mountain veins and entire rocks. Its crystals, when pure, are rock crystal: purple-coloured are called amethysts, and yellow, topazes.

Felspar, next to quartz, is the most abundant stone; being a constituent of granite and other rocks. It scratches glass, and gives out sparks with steel; but is inferiour to quartz in hardness. It is the petuntse of the Chinese, and the vitrifying ingredient of their porcelain.

Silex is a stone sufficiently hard to scratch glass—sparkling, but never in crystals. Common flint and light-coloured pebbles are wholly of this stone.

Calcareous spar is crystallized carbonate of lime, one of whose purest varieties is Iceland spar.

Iceland spar, the substance which produces double images, consists of 56 lime and 44 carbonick acid, with a specifick gravity 2.714. The faces are parallel, and inclined 105° 5′, but even and polished, splitting always on the face. From this cause it produces a double image, a direct one, and another which is the result of all the reflections from all the surfaces, which being regular, p oduce a definite effect. The same property

is possessed by all transparent bodies, made up of little regular cubes, and the extraordinary ray is a result of the regular reflections at a definite angle from all the surfaces. In glass, water, &c. there is no such set of surfaces; and the light is, therefore, diffused through the mass, producing no regular secondary ray, only a general luminosity.

Agates are aggregates of different species, as quartz, flint, amethyst, &c. differing in colour and transparency, but sliding into one another by imperceptible gradations. Mocho stones containing little stems of moss, and varicgated Scotch pebbles, are agates.

Glauberite is a crystallized salt, composed of nearly equal parts of sulphate of lime and sulphate of soda, without water. It is found among the rock salt of South America.

Analcime, or cubizite, is found in grouped crystals, deposited by water in the fissures of hard lavas. It melts under the blowpipe into semi-transparent glass.

Zircone is a hard transparent stone, susceptible of a fine polish, and has a double refraction. It has two varieties, hyacinth and jargon; the former yellowish-red, and the latter without colour.

Tabasheer is a transparent fluid in the joints of the bamboo. It thickens till it is converted into a white solid, and is composed of silica. Humboldt discovered it in the bamboos of South America; and a solid pebble is so hard as to cut glass.

The Emerald is ranked among the gems, but is now found only in Peru. It is green, harder than quartz, and always in crystals. Oriental emerald is a green sapphire.

The Beryl is a variety of the emerald, of a paler green or blue. The emerald of Brazil is a tourmaline.

Corundum is a stone found in India and China, which in crystals, is a six sided prism, and called adamantine spar.

The Amethyst, Ruby, Sapphire, and Topaz, are varieties of this spar, differing chiefly in colour. The amethyst is reddish violet; the ruby red; the sapphire blue; and the topaz yellow:—termed oriental gems.

The tourmaline is hard enough to scratch glass, and becomes electrick by heat. It is transparent when viewed across the thickness of its crystal, but opaque when turned in the opposite direction.

Apophyllite, or fish-eye-stone, has a pearly lustre, like moonstone, and its crystals are various.

Leucocyolite is a name given to a variety of apophyllite.

Cairngorm is a species of quartz.

When fluids evaporate and become solid, or when they freeze, they generally solidify in regular figures called Crystals, sometimes cubes, or four-sided, six-sided, eight-sided, or twelve-sided figures, terminated by ends always regular. The separation and analysis of these figures reduces them to six primitive forms. 1. The parallelopiped, with six parallel sides, of which there are forty species of minerals. 2. The octahedron consists of two four-sided pyramids, joined at the base, and contains thirty species of minerals. 3. The tetrahedron consists of four equal triangles, and belongs to only two minerals, ores of copper.

There are from 12 to 1500 different crystals; and one observer has described 642 crystals of carbonate of lime.

The crystals of congealing water shoot at an angle of 120°. When solutions freeze it is the water in them that freezes and the foreign substance is entangled or sometimes separated.

When water solidifies into ice, its crystals cross each other at angles of 60°, and enlarge the bulk nearly an eighth, with such force as to explode rocks, trees, and even pieces of artillery.

Mica and tale are prisms with rhomboidal bases, with obtuse angles of 120°. Felspar is an oblique quadrangular prism, with a parallelogram. Sal ammoniack takes the form of octahedrons and cubes; and fluor spar of cubes. The diamond is often in the octahedron form, but it varies.

Mica is found in such large plates

in many mountains, as to be used as a substitute for glass, being semi-transparent, tough, flexible and elastick. In Siberia, some specimens are 2½ yards square.

Certain bodies, when passing from the fluid to the solid form separate into portions or crystals, assuming a determinate angular shape. It is a species of congelation; and ice was called *crystal* by the Greeks.

Some crystals are rhombs or rhomboids, because they are solids whose faces have those figures, and are rhomboidal solids. Others are described by the number of their sides or faces. One with four faces is called a tetrahedron; with six, a hexahedron; with eight, an octohedron; with twelve, a dodecahedron; with twenty, an icosahedron; and one having many sides, is a polyhedron A cube is a hexahedron.

Rochelle salt crystallizes in large regular eight sided prisms.

Gold, silver, and copper pyrites, and salt, crystallize as cubes. Calcareous spar (angle 105°), quartz, emerald, and tourmalin crystallize as parallelopipeds, with rhomboidal sides, i. e. with unequal angles. Diamond, the magnet, antimony, and bismuth have the regular octahedron form; calomel and topaz, the same form with right angle bases. Sulphur and carbonate of soda the same in two pyramids with rhomboid base. Emerald and cinnabar have six-sided prisms.

Hauy, in his theory of crystallization, conceives that all the forms may be produced by atomick molecules of three species. The tetrahedron, the triangular prism, and the parallelopiped, of four, five, and six sides: and Wollaston conceives that even these figures may be formed by piling spherical atoms, which he considers the fundamental form.

The six-sided prism consists of six equal right angled sides with a six-sided base; seven pieces of mineral are of this form.

The dodecahedron, of which there are two figures; one the rhomboid and the other the triangle. Two minerals have rhomboid sides, one of which is garnet, and two only the other.

Gold and silver crystallize in four-sided pyramids: copper the same: tin in rhombodial prisms: lead in four-sided pyramids: zinc the same: bismuth in four-sided parallelopipeds: antimony in oblong perpendiculars: arsenick in tetrahedrons.

In crystallizing, fluor, spar and common salt make cubes. Nitre a six-sided prism, and sulphate of magnesia a four-sided prism.

The *diana arbor* is a tree like crystallization of silver and mercury in nitrous acid.

Common salt dissolved in viscid liquids crystallizes like the leaves and branches of fir.

Goniometers are delicate instruments for measuring the angles of crystals, and a very accurate one has been invented by Dr. Brewster.

A nail-maker has made by hand 17030 flooring nails in a week. Each nail takes twenty-five strokes with a 2 lb. hammer, and from one to three blasts with bellows.

Naphtha is purer and lighter than the petroleum of coal, of which it seems to be a native species.

Putty is oxyde of lead, or whitening and sweet oil.

Ochres are earths and oxydes of iron.

Earth is eaten as bread in several parts of the world. Near Moscow, a hill furnishes earth of this description, which will ferment when mixed with flour; in Louisiana, the Indians eat a white earth with salt; and the Indians on the Oronooka eat a certain unctious earth in like manner.

MOUNTAINS.

The old continent may be considered as having for its nucleus an immense chain of mountains, which stretches 8000 miles from east to west, under various names. In Europe, it bears the names of Pyrenees, Alps, &c. and in Asia; Caucasus, Himalaya, and Thibet, and Tartary, till it reaches the Pacifick Ocean. Atlas is part of this ridge; and Etna and the Greek mountains are

branches of the general chain. The heights are various; or in Europe from 6 to 15000 feet, and in Asia from 10 to 28000. This ridge, then determines the general form of the continent, and the course of the rivers. Some call it the spine of Europe and Asia; while the Andes in America, are called the backbone of that continent.

The countries to the north and south are governed in their elevation by their connexion with this great chain: some are its valleys, and others are table lands or steppes, all sustaining different levels from the sea. Italy is merely the declivities of the Appenines, and Barbary of the Atlas chain; and Bohemia is a circular valley, and Hungary another. Asia Minor is an elevated plateau; Persia is also a high plateau depressed in the middle; Thibet is a vast plateau, more extensive and more elevated, sustained on one side by the Himalayas, and on the north by the Altai mountains, both 20000 feet high, while the immense plateau is 9000 feet. The tract northward of the mountain chain is a vast plain, which includes England, France, Holland, Germany, and Russia to the Ural chain, so level that it has been said a ball with sufficient force would roll from Paris to Petersburgh; the whole is a flat between the sea and the mountain chain, descending to Holland and the shores of the Baltic. All the rivers run from the chain to the German, Baltic, or Northern Ocean. But the Danube and Wolga, filling up the basin of the Black Sea, also concurs with the Nile, to fill up the valley or great basin of the Mediterranean.

South of the great chain, the deserts of Africa and Arabia, and the plains of India present themselves; and the rivers, the Indus, the Ganges, &c. fall, with the land towards the Indian and Southern Ocean.

The Southern Ocean itself is an extraordinary phenomena: it covers a third of the earth, and bounds have been set to its encroachments by pointed capes, whose foundations are connected with the granitick base of the earth. Its disposition to encroach on the land is evinced by the acute angles and mountainous character of all the promontories which present themselves to it; while in the north, the passive character of the ocean is evinced by the obtuse forms both of Asia and America. The elevated land of the old continent occupies a space equal to five millions of square miles.

In America there is a similar mountainous ridge, of which all the habitable land is the declivity. It begins in the Rocky Mountains and the Alleganies, in lat. 45, and extends to the Straits of Magellan; but it differs from the other great chain in being from north to south, owing to which its great rivers run from west to east, except the Mississippi, the Missouri, the Ohio, the Paraguay, and the Parana.

The greatest elevations are in the torrid zone, and are from 20 to 28000 feet; those in the temperate zone are from 12 to 16000; and those in the frigid, only from 5 to 6000. The elevation of perpetual snow varies with the heat of the surface. Near the equator it is 15700 feet; within the tropics 15000; in the temperate zone 8600; and in Norway from 4500 to 5000. Under the equator the fertile plains of Quito are 9500 feet above the level of the sea. The town of Riobamba is 10700 feet; and the city of Mexico enjoys a fine climate at 7500 feet; while in Europe, &c. the hardiest pines grow only at that elevation: and in the frigid zone, only at the height of 500 feet.

The Andes chain is 4600 miles long from the Straits of Magellan to the Gulf of Darien, about 100 miles from the shore of the Pacifick, and of an average height of 1½ mile from the level of the sea. In truth, the same chain runs through Mexico and to the Rocky Mountains of North America and the Alleganies in New England. It is a sort of buttress against which the whole American continent leans, and the nucleus of its formation by the washing of the hills, and the working of the ocean. They are chiefly composed of clay slate, on which lies limestone and iron sandstone, while the loftiest are the newest porphyry, with little visible granite. The clay slate is supposed to be volcanick, as volcanoes are numerous, and they exude mud and clay, which in thousands of years become clay slate, and hence

organick remains at heights of two miles.

Mont Blanc is the highest of the Alps, and in Europe. It is 15600 feet, or three miles above the level of the sea. Snow lies constantly on its sides 12000 of these feet. The summit is a narrow ridge, like the roof of a house; its uppermost rocks consist of strata of granite, nearly vertical. De Saussure at the top, on the 3d of August, found Fahrenheit 27°, while at Geneva it was 82°; the barometer fell to 16.02, while at Geneva it was 27.2: and the air contained six times less humidity than at Geneva. Respiration was difficult and sounds very feeble; and the pulse was increased to nearly double. Many perish in attempting to ascend it. To the dryness of the air Saussure ascribed his extreme thirst.

The Caucasian Mountains lie between the Euxine and the Caspian. The story of Prometheus is referred to these mountains; and probably it arose from the fires at Baku, in their vicinity. They are from 3 to 400 miles long, and about 200 broad, consisting chiefly of granite and limestone, and their tops are covered with snow and ice, the lower parts abounding in rich minerals. Elbrouse, the highest, is 16800 feet; and the people say it is the residence of the king of the hobgoblins. The valleys are exceedingly fertile, interspersed with noble forests. There are also several hot and mineral springs of remarkable character. Strabo says the inhabitants speak seventy languages; and modern discovery proves that there are an astonishing diversity. Among them are the Circassians, called the Adege, and the Cossacks, so effective in the Russian army. The whole tract is now absorbed in the Russian empire.

The Altai Mountains are 5000 miles in length, in Siberia, and often as high as the Alps.

The Dofrine mountains in Scandinavia run from 8000 feet to 6000, but are chiefly remarkable for the richest mines in Europe.

The Carpathian mountains in Hungary are 4 or 5000 feet high, and contain the richest known copper mines as well as iron, lead, gold, and silver.

The Appenines are from 4000 to 6000 feet high, and covered with woods and pastures to their summits. Large tracts of the valleys are very fertile, but others emit sulphureous vapours, and have become desolate, owing to the cupidity of the great land proprietors, who in past ages demanded higher rents than the farmers could pay.

The peak of Teneriffe presents five zones of different vegetation: for 7 or 800 feet it produces vines, corn, olives, &c.; the second zone produces myrtles and trees, the third chiefly pines, the fourth and fifth produce little vegetation and are very cold; the upper part is covered with pumice stones and lava. In the middle is a cone, and on the top of it a crater 300 feet long and 200 broad, and of evident antiquity, such that Humboldt conceived it had not been in action for some thousand years. The whole mountain appeared to be volcanick, and its recent eruptions have been made from the sides.

The highest peak of the Rocky mountain is 12500 feet, and James's Peak is 12000 feet. Mount Washington in New Hampshire is 6634 feet.

The European mountains consist of primitive and transition rocks.

Mount Carmel, so often referred to in the Jewish histories, is the highest of several mountains in its vicinity. The valley of Sharon lies to the south of it, and forms a grand promontory in sailing along the coast. It is 2000 feet high, shaped like a flatted cone, with steep and barren sides. There is a chapel on it, and some monks called Carmelites.

Mount Athos in Macedonia, is above a mile high and inhabited by 5 or 6000 Greek monks who have twenty-four monasteries on it.

There are six hills in Scotland nearly of the same height; Ben-Nevis and Benwyvis, 4380 feet each; Benmaeoudie, 4300; Cairngorum, 4060; Benlawers, 3978; and Rona, 3944.

It is thirty miles from the foot of Etna to the crater, and the surface of the entire mountain is 1900 square

miles. The great crater is ten miles round and 400 yards high. Pindar called it the pillar of heaven, and Deucalion and Pyrrha were said to have taken refuge on it to escape the deluge. The perpendicular height is 11000 feet, or rather above two miles.

Snowdon is 3600 feet above the level of the sea, and the promontory of Penmaenmawr, at the edge of which a road passes, is 1550 feet.

Height of the hills and mountains, by Reddel's scale :—

Race-course, Brighton	feet 400
Monmouth hill	450
Arthur's seat	800
Dunsinnan	1030
Edgecombe	1300
Malvern	1350
Wrikin	1450
Penmaenmawr	1460
Gibraltar	1470
Pentland	1600
Three Brethren	2000
Sion	2100
Vaucluse	2150
Inglebrough	2280
Wharnside	2500
Cheviot	2670
Sinai	3000
Saddleback	3080
Schehalhien, Skiddaw, and Ben Lomond	3280
Montserrat, Athos, and Hartfell	3300
Helvellyn	3350
Snowdon, Table, at Cape	3500
Stromboli	3850
Vesuvius	3900
Parnassus	3950
Ben Lawers	4030
Ben-Nevis	4400
Soufriere	4830
Hecla	4900
Puy de Dome	5200
Port des Franeois	5760
Col de Tende	6100
Stony Mountains	6450
Olympus	6500
Simplon	6600
Cenis	6800
Rouge	7650
Santa Fe	8700
Pilate	8950
St. Gothard	9080
Carnigou, Pie du Midi	9300
Parmesan	10090
Buet	10120
Pie Blanc	10400
Etna	10950
Perdu	11200
Hochhorn	11300
Egmont	11440
Atlas and New Zealand	12000
Argentiere	12180
Teneriffe	12250
St. Elias	12700
Ophir	13850
Ortel	14400
Dome de Gonte	15500
Southern Thule	15100
Rosa	15550
Pichincha	15600
Blane	15680
Tartarian	15800
Cotoeaehe	16450
El Altar and Hiniea	17500
Cotopaxi	18900
Disis Casada and four others	19500
Chimboraza	21000

There are 120 mountains or ridges above 10000 feet above the level of the sea, and 150 from 5000 to 10000, many of them extensive ridges.

Mont Blane is 14542 feet above the Lake of Geneva, and this 1233 feet above the sea.

Sukanda, in the Himalayas, is 25500; and Dhawalagiri, in the same chain, is 27000 feet, and visible above 250 miles. Nineteen of these mountains are higher than Chimborazo.

A village in the Himalayas is 14700 feet high. The goats produce the wool for shawls. At 15500 feet beds of fossil shells were found. At 20000 feet there was not perpetual snow. They have been ascended 19600 feet.

The Alps cover 600 square miles. They are divided into the maritime, the Cottian, the Greeian, the Helvetian, the Pennine, the Rhœtian, Carmi, and Julian. The heights are—

Jung franhorn	13739 feet
Mount Blane	15680
Rosa	15552
Cervin	14784

Mount Perdu, in the Pyrenees, is 11270 feet high, and the Sierra Nevada is 11660 feet high. Snow is permanent above 8900 feet.

The Allegany Mountains in New Hampshire are 8000 feet, and the range is 900 miles. They consist of granite, slate, and limestone, filled with organick remains.

Mount Ararat is 16200 feet.

On the Brocken, the highest of the Hartz Mountains, a spectre is seen,

of which superstition has made a profitable use, and formerly there was a temple on it; and to this day there is the sorcerer's chain, the magick fountain, and the sorcerer's anemone. The spectre is seen in the afternoon, when the sun, at a certain height, projects the shadow of the spectator on any clouds or mists in the atmosphere. His image is thus seen several hundred feet high; and all his motions are displayed by the non-reflection.

The mountains of Seger, in Arabia, produce frankincense; and those of Safra, the balm of Mecca, from the amyris opobasamum, which in the early ages sold for its weight in gold.

The Steppes, in Asia, consist of extensive tracts nearly level, and without trees; the soil sandy, and serving the Tartars to graze their flocks and horses. Those near the Black Sea afford abundance of salt, a proof that it formerly exceeded its present size.

There are on mountains perpetual snow levels, at the following heights.

On the Andes, lat. 2	14760 feet
Mexico, lat. 19	13800
Teneriffe ..... no snow at	11454
Etna	9000
Caucasus	9900
Pyrenees	8400
Alps	8220
Iceland	2890
Lapland	3100

On Chimborazo, the upper 5400 feet is perpetual snow.

The Himalayas have perpetual snow.

One of the most remarkable precipices is at Table Mountain, in South Carolina. It is 3000 feet high, and stands on the edge of a valley, which nearly doubles its perpendicular elevation. Near it is a cataract which falls 6 or 700 feet. In the plains around, a strata of shells, beds of oyster shells, and petrified fish, are found in great abundance. There are also found enormous bones of unknown animals, the ribs of which are six feet long, the teeth above eight inches, three and a half wide, and nearly a foot in the root.

Though the Caspian Sea is remote from every other, yet the water is salt, and abounds in fish, and the usual marine productions.

There are, in different parts of the earth's surface, above 200 volcanoes, which have been active in modern times. Their products, in many countries, prove that in certain states of the earth they must have been more numerous. When the fermentation is commencing, smoke appears; noises are heard; earthquakes take place; and explosions of ashes, sand, and stone, precede the flow of melted lava. The smoke consists of steam, and carbonick, sulphurick, or muriatick gas. The ashes appear to be exploded lava, and are often carried by the wind 1 or 200 miles. Thick accumulations of them form a compact stone, called tufa; the scoria is like the slag of iron furnaces. The explosive force is such as sometimes to throw stones of 1 or 200 tons eight or nine miles. Lava is a stony substance like basalt, and may sometimes be seen at the bottom of a crater red hot, like melted metal, bubbling like a fountain. When it overflows the crater it is very fluid. At Vesuvius, a red hot current of it was from eight to ten yards deep, 2 or 300 yards broad, and nearly a mile long. Mount Hecla, in 1783, threw up a current of burning lava, sixty miles long and fifteen broad. In Mexico, a plain was filled up by it into a mountain 1600 feet high, by an eruption in 1759. Its heat is so great that it continues to smoke for above twenty years afterwards; and a piece of wood took fire in lava 3½ years after it had been ejected, at a distance of five miles from the crater. Sometimes they throw up mud, and produce extensive devastations. Black volcanick glass is obsidian.

Isolated mountains are generally volcanoes, as Etna, Teneriffe, &c.

Granitick mountains are rugged and precipitous; gneiss, less so, and slate smooth and round. The European and Asiatick mountains are crowned with granite; but the Andes are crowned with whinstone, or the newest floetz trap: and granite does not rise higher than 10 or 12000 feet. Chimborazo has porphyry at its summit, and Pichinca basalt. Limestone is also found at great elevations.

Most mountains present their precipitous faces to the sea, and their slopes to the land.

GEOLOGY.

The surfaee of the earth is 196862-256 square milcs; and its solidity is 259726936416 eubick miles.

The sea is to the land, in round millions of square miles, as 160 to 40, or as four to one.

The earth is, according to differcnt mcasurements, 7912, 7916, and 7924 miles in diameter; and about 24860 or 24880 miles round.

Mathematicians have not agreed about the exaet proportions of the earth's equatorial and polar diameter. Huygens made it 578 to 577. Newton made it 230 to 220. Bouguer 179 to 178. Others make it 266 to 265; and La Place makes it 334 to 333; Maupertius and Bernouilli 129 to 128.

Bodies are lighter at thc equator than towards the polcs, owing to thc sphcrical figure, and to the cosines not shortcning so much as the sines increase; the former bcing thc centrifugal and the latter the centripetal force dirccted to the equatorial plane. But Newton aseribed it to bodies being nearer the centre at thc pole, than at the equator.

Those of the ancients who did not belicve in the sphericity of the earth, thought it a eylinder, or an extcnded planc. Homer madc it circular, and the outside water, and this was the idea of the Jews. The later Grecks from Pythagoras and Thales taught the sphcricity. But the popes bclievcd it a plain, giving all to the west to the kings of Spain.

The Regent's park is about one eubick milc. Now, suppose a pillar, the base of which is the same size, and about thirty times higher than St. Paul's dome; this pillar would be about onc square mile, and about 250 thousand millions of these pillars would be nearly cqual to the whole earth.

The original surfaee of the earth is supposed, by Wernor, to have been granitc, with pinnacles or deep cavities and hollows; and that then the gneiss, &c. was generated from it; and thc other strata, one above the other, from the remains of each, with frequent intermixturcs. Others suppose the gneiss, miea-slatc, and clay-slate to be as old as the granite, and to be arranged and lapped ovcr each other like the scalcs of a fish. Proeesses of wastc, deeay, separation, and combination, appcar to have resultcd from thc eontinued aetion of air, heat, water, and central foree. It appcars that the older seeondary formations consist of the very substanecs of the primary re-united by ccment, whilc their debris again constitute the newer secondary; and the ruins of quartz rocks form sandstone and loose sand; and the ruins of slate and trap roeks, beds of elay. Such is the general souree of the silicious and argillaeeous earths whieh eover the earth; the detailed study of which constitutes the extensive sciences of mineralogy and geology.

Taking the land on the globe at 160 the surface of thc sea is forty, and seven twelfths arc in thc southern hemisphere, the water being to thc land as thirteen to two, and in the northern hemisphcre as seven to fivc. The mean depth of the oeean is caleulated by La Plaee and others at two miles, and its cubick contents at 290 millions of miles. The Pacifick ocean covers 88 millions of square miles, the Atlantick 25000000, the Indian ocean 17 millions. The southern ocean to forty or fifty degrees is 30 millions, thc Mediterranean one million, the Black Sea 170000, the Baltie 175000, the North Sea 160000, thc Persian Gulf is 600 miles long, and thc Red Sea is 1500 miles, without a river.

The surface of the sea is estimated at 150 millions of square miles, taking the whole surfaec of the globc at 197 millions, and its greatest depth is supposed to be equal to that of the highest mountains, or four miles; but La Place thinks that the tides demand an average depth of three miles, therefore, the sea would eontain 450 million of cubick miles.

The quantity of water discharged into the sea by all the rivers in the world is about 36 cubiek miles in a day, hence it would take above 30000 years to create a circuit of the whole sea through clouds and rivers.

Thc sea continues to encroach on the Cornish coast. Mount's Bay and St. Ive's are expected to meet, and placc Penzance on an island. Scilly anciently joined the Land's End, and St. Michael's Mount has

not been an island for many centuries.

Rivers are a beautiful part of the harmony of Nature. The sea rises in fresh vapours, it falls in rain, fertilizing the ground, and returns by the lowest levels to the sea again, forming a channel in the soil; and when the fall is not sufficient, lakes more or less extensive, and courses more or less devious as the land is hilly or plain, are formed.

Rivers and tides produce silent but great changes in the forms of land, and they flow in the lowest levels, but overflowing and contracting, they soon form decided channels by raising the banks with mud and vegetation. Sometimes their course is interrupted, and they form lakes which enlarge till they overflow, and hence cataracts. The St. Lawrence is an example of these circumstances.

The mud of large rivers extends continents at their debouches; the subsiding mud forms deltas of lowlands which in time unite with the main land and form the plains. The Amazons, the Oronooko, the Mississippi, the Nile, the Danube, the Wolga, and the Ganges all have islands at their mouths, and the sea is muddy for a great distance. The Mississippi adds 300 feet per annum to the main land from this cause; the Nile has advanced the land sixteen feet per annum since the time of Herodotus, and has raised the surface of Egypt four inches in a century. The Po carries out the land 228 feet per annum, and consequently Adrea, which 2500 years ago was upon the sea, is now twenty miles from it The Yellow river in China carries down two millions of cubick feet per hour of alluvium, so as to be likely to fill up the Yellow sea. The Nile begins to rise in June, and attains twenty-four to twenty-eight feet of elevation in the middle of August, and then floods the valley of Egypt twelve miles wide. The Ganges rises from April till August thirty-two feet, and then creates a flood 100 miles wide. The Euphrates rises between March and June twelve feet and covers the Babylonian plains. The Mississippi rises with the melting of the snows from March till June, and forms breadths of rapid water of vast extent. At the distance of 1000 miles from the sea, it rises fifty feet and by spreading over a large tract rises only twenty-five at 300 miles, and twelve feet at 100 miles.

Corals and their operations are the most extraordinary species of existence known to us. Their vast fabricks in the sea are produced by the unity of action, though each animal lives a solitaire in its own solid shell. Yet the chief part of their structure is a common wall, to protect their community from the usual swell of the ocean. They consist chiefly of madrapores, while other shell fish congregate on and near their structures. One reef, on the coast of New Holland, in fathomless seas, extends 1000 miles long and from 40 to 50 broad: one vast mass of limestone, likely ere long to be dry and fertile land. They are supposed not to work above the water, though their rocks are found from 100 to 300 feet above the level of the sea.

The numerous islands on the coast of Norway generate currents, and one of them called Maelstrom, runs between some islands six hours from north to south, and six the contrary. Against the tide and in stormy weather, it is fatal to navigators, and even to whales. At high and low water, and in summer, it may be crossed without danger.

The vast tract of land between the Andes and the Atlantick is so level, that in 300 miles the river Paraguay does not fall above a foot. Three rivers fall into an estuary of fresh water, called the Rio de la Plata; which at is efflux, is 150 miles broad, and 30 miles over, opposite Buenos Ayres. At 200 miles distance, it receives several rivers besides the Paraguay, and this receives the Parana and Araguay, which run to the Andes.

The country near the Oroncoko and its tributary streams, is flooded in the rainy season to a vast extent; and the Oronooko near its mouth, expands over the land in June, July, and August, 5 or 600 miles.

The narrowest part of the Atlantick is more than two miles deep. In other parts it is about one and a half mile.

The remains of animals and vege-

tables in the rocks and earthy strata of the earth, are the true and only means of ascertaining its history and natural changes before the records of man. The discoveries made on this subject within the last half century form an era in science in which the name of Cuvier will always be distinguished. In all countries, on digging to certain depths, and in mining, the remains of fishes, vegetables, quadrupeds, and birds are found in the soil or imbedded in the rocks, except in those of primitive antiquity. The general regularity with which those that are marine are laid at one level, and those which are products of land are laid at another, and the alternations of these marine and land products, lead to the conclusion that the sea has repeatedly covered the land for long periods of time, and that the land has, at intermediate periods, been dry; and what is very remarkable, the remains found consist, and always at certain depths, of species of animals, vegetables, &c. not now in existence, and often of genera not natural to the present climate. Cuvier has enumerated several hundred genera of animals, fishes, and vegetables so found, of which there are none of the living genera or species. The lowest rocks, it is therefore inferred, were at one time the surface of the earth and the seat of organick life. These appear to have been destroyed by some great revolutions which brought new tribes of organized beings, while their kinds prove that the surface was covered with water. The subsequent appearance of amphibia, &c. prove the development of dry land; these appear to have been swept away, and among later solid rocks, the monstrous race of herbiverous quadrupeds and gigantick lacerta came into existence when the earth seems to have acquired herbage for their subsistence. How long this race kept possession cannot be guessed, but their length of life is well known. The gypsum, &c. which now contains their remains is covered with newer deposits, abounding in sea shells, and above the stratum is found a new race of herbiverous animals of the genera of the elephant, rhinoceros, &c. and above them is the first loose soil, intermixed with marine substances, proving second or third immersions of the sea; and above this lies the soil which the present race of animals enjoy. What may follow, and when, and how, is a curious question.

The age of the rocks indicates the age of the remains, but we can measure neither by any comparison with known time.

The older secondary rocks contain peculiar aquatick plants and reeds, then above these madrepores, corals, &c. all fixed where they lived; then shell-fish, very simple, but differing from all now in existence; in strata above these fishes, bamboos and ferns; in a still higher stratum are more complicate shells and oviparous amphibia, as crocodiles, tortoises, and reptiles; these are imbedded in the uppermost solid rocks of the oldest secondary formation.

In the newest solid rock formations, whales, seals, and birds appear; above these land animals of enormous size, birds and fresh water shells, all in concrete rocks.

Above these, in the lowest beds of loose soil and peat bogs, elephants, elks, rhinoceroses, of peculiar species are found. Near the surface is found the remains of the existing races. Human bones have only been found among these.

It has been suggested that all these phenomena of the surface of the earth (for to the depth that man penetrates is to be regarded as surface) are occasioned by the oblique and eccentrick motions of the earth as a planet, and of its varied reactions in connexion with the forces which produce the motions. The different distance in the perihelion and aphelion, which points progress round the ecliptick in every 20900 years, is one of the chief causes; the difference of reaction at the two distances being effected by the mobile waters; and greatest, and therefore most accumulating, being in the hemisphere over which the perihelion is acting. At present, and for 6000 years, the perihelion has been vertical over the southern hemisphere, and to this cause is ascribed the vast preponderance of water in the southern hemisphere and the draining of the

northern hemisphere at and since that epoch. Another general cause is the variable obliquity of the ecliptick, by which the tropicks are at present narrowing at the rate of 52 seconds in a century; a motion which it is supposed may be accelerated at times by the other cause and by the variable disposition of the dry land.

A bat has been found in limestone, opossums in slate, guinea-pigs, rabbits, rats, and beavers in limestone: the sloth, one fourteen feet long, in South America and in limestone caves. Bears, dogs, foxes, and wolves in diluvial soils and caves; hyænas and tigers in limestone caves and marl; the teeth of horses, elephants, rhinoceroses, hyænas, bears, wolves, tigers, &c. are found in masses in diluvial soils; oxen in peat-bogs in several countries; deer and elks in peat-bogs and marl-pits, one six feet high and nine feet long was found in the Isle of Man, in marl, covered with sand, then peat, and then the vegetable soil. Rhinoceroses are found in every part of Europe and in the arctick circle; the hippopotamus is found in England, France, and Germany.

Elephants, and animals much larger than elephants, called mammoths, have been found in Europe, America, and Siberia. One found near Abingdon, now at Oxford, is sixteen feet high, and its bones were mixed with those of other large animals: another was found in Siberia in the ice, quite perfect in its flesh, skin, hair, and eyes, with a long mane and tail of stiff black bristles; others have been found in Hudson's Bay. The gigantick mastadon is found in North America and Siberia. The gigantick tapir, twelve feet high and eighteen feet long, has been found in different parts of Europe. Whales are found in Essex, in London clay, and in Bath limestone.

The fossil or organick remains in strata are always the same kind in similar strata, and generally have characters of simplicity of structure, proportioned to the age or depth of the stratum. According to Kirwan, petrifactions or fossil remains are found in marl, chalk, limestone, or clay; seldom in sandstone, and rarely in gypsum; never in gneiss, granite, basalt, or shorle: but sometimes in pyrites and ores. They are impregnated with the species of earth in which they are formed Those in slate or clay are compressed and flattened.

In the oldest *limestones* are found worms, tubipores, millepores, belimnites, ammonites, nautilites.

In *argillaceous schists* of primary formation are found the same, and corallites, echinites, fishes, leaves, reeds, palms, &c.

In the *lowest secondary sandstone* are found the preceding with orthoceratites, and pectinites.

In the *secondary limestone* below coal are found the same with griphites, ostracites, buccinites, &c.

The *coal* above the preceding evidently consists of bitumenized timber, with leaves and shell and branches of shrubs lying upon the beds, and shells, &c. in the shale between the beds.

Red marl or sandstone contains all the preceding, together with crabs and amphibia, and fishes.

The strata between the preceding and chalk contain every variety of shells and zoophites.

Chalk abounds in fossil remains like the preceding, with sponges, primites, tortoises, and parts of fishes Above the chalk the lowest marine limestone, and two other strata above it, contain similar remains, with leaves of fuci; and the sandstone above is similar.

Gypsum, the lowest fresh water formation, contains various large animals of the genus palœothera, canis, anoplothera, saurus, &c. besides birds, fishes and palms.

Above the *gypsum* is a marine formation of gypsum and marl, containing marine shells, crabs, and fishes.

The *upper sandstone* contains various marine shells of a dozen genera.

Above this is another *fresh water formation* containing various animals with silicified wood, and remains of crocodiles, turtles, lobsters, sharks' teeth, and branches of trees with fruit.

Chalk also contains marine substances, from the sponge to the alli-

gator; and *clay* contains crabs and lobsters, shells, fishes, crocodiles, fruit, fossil wood, and seed-vessels of woods in great varieties. Diluvial rocks contain elephants, &c. Below chalk the remains are marine; but chalk and the coal formation and upwards contain marine and land remains. The upper old formations contain the larger animals, and the alluvial and newest strata, subjects with which we are familiar.

One hundred genera of multivalve and vivalve shells have been discovered, and of some of them there are hundreds of species. Eighty genera of bivalves are also enumerated, besides thirteen genera of zoophytes. Most of the shells are of genera no longer in existence, and their forms, often gigantick, create astonishment in the most listless. Ammonites alone form some hundred species from a diameter of four or five feet to aggregated millions of a few pounds.

Cuvier establishes thirty-six new genera of fossil quadrupeds now unknown, besides uncertain ones, and forty-nine species. He thinks the oviparous animals were more ancient than the viviparous, that they might have been contemporaneous with the more ancient fishes, but that quadrupeds and mammiferous animals were far more recent.

Several immense basins of rock have been discovered, which are now filled up and level, as the Paris basin, that of the Isle of Wight, and that from Sheepy to Reading, on which London stands. First, there is a marine stratum in them on chalk, of sand and clay with shells; the next stratum is fresh water deposits; the third marine, the fourth fresh water, and then over this are alluvial deposits. The basins are 500 feet deep, and below them are limestone, marl, sandstone, chert, and shale, all containing marine shells. The lowest of the fresh water contains palm-trees, amphibia, quadrupeds, and birds. The third contains fishes and crabs, and covers the second with marl, sandstone, and quartz, of the kind called millstone. The fourth contains fresh water shells and vegetables. The alluvial contains various strata, and remains of elephants, trees, and many large unknown animals, and on this lies the soil of the surface.

Mount Bolca, near Verona, presents the most numerous specimens in Oryctology which have yet been found in one place. Bones of elephants, stags, bears, and phocæ, 200 genera of unknown testacea—200 species of petrified shells, belonging to different modern seas and climates, with zoophytes of different genera, and remains of birds and insects are found in immense masses, basaltick columns, scoriæ, lava, &c. appear, the whole proving that fire and water have operated in remote ages.

The remains of land animals are not more remarkable at Mount Balca than those of marine productions, for the fishes of all modern seas and rivers are imbedded in the calcareous quarries, a sort of marly schist of a light gray colour, affording a fœtid odour like putrefaction. In general they are perfect, and not mere impressions; there have been ninety-four species found, one three feet in length, and a young shark with its food undigested in the stomach, and another fish has one half swallowed in its throat. Fish of the Japanese seas, others of rivers in India, and some peculiar to fresh water lakes, while many of the specimens belong to genera and species no longer in existence. Marine plants are imprinted on the stones, and among the remains of birds a petrified quill has been found. To account for the varieties, it has been supposed either that a volcano increased the temperature of the surrounding sea, or that the gulf of a volcano may itself communicate with the sea, and the fish be involved, for it appears that fish are frequently thrown in prodigious numbers from craters of burning volcanoes. An apothecary at Verona lately possessed a cabinet containing 600 fishes of different sizes extracted from Bolca, and the Marquis Douisi had 800 specimens, many of extraordinary size. For further details and arguments on this very curious subject, the reader may consult the article Bolca, in Brewster's Cyclopedia.

Brogniart, in his Geological Flora, classes plants into four periods: 1, The transition and coal formations; 2, Variegated sandstone; 3,

The chalk; and 4, Above the chalk. He conceives that the successive creations are distinguished by a sudden change in the essential characteristicks. Those of the fourth period are similar to the present. Below the chalk the most perfect are the *cycadeæ* and *conifera*. A land vegetation marks each period, while one family of one period runs into another. The dicotyledonons begin in the oldest strata of the secondary formations, and increase in the more recent.

Eight species of birds are found in gypsum, near Paris. Crocodiles are found in blue clay in Dorsetshire, and on the opposite French coast.

Lizards, twenty-four feet long, equal to the dragons of antiquity, are found at Maestricht, and in Bavaria.

Lizards found at Stonefield must have been forty feet long and eight feet high. Fossil fishes occur every where, and in all forms. Crabs are numerous, as well as other shell-fish.

Insects are found in slate, and flies and ants in amber; and a perfect scorpion was found in a piece of amber.

70 genera of univalve shells have been discriminated; and other shells are so numerous and novel as to fill large books with their descriptions. Their masses are so great, that many have supposed that the vast mountains of limestone are formed of their remains.

Marbles are composed for the most part of them, and in many kinds the forms are perfect. They are found at every depth which has been penetrated, and under beds of stone a thousand feet thick.

In France, at 100 miles from the sea, a single oyster bed was found, which, in oysters and other marine bodies, is equal to 500 millions of cubick yards.

Sharks' teeth and fishes' teeth abound in Oxfordshire.

Fossil shells are found in mountains every where; and they abound in the stones of which the Egyptian, Grecian, and Roman structures are formed.

Miners are familiar with a prodigious variety of vegetables, none of them like the plants of the present country. Remains of plants and tropical plants are found in England, and all over Europe.

Forests of standing trees have been discovered in Yorkshire and in Ireland, imbedded in stone.

Shells, bones, teeth, and various vegetables, are scarcely altered. In other cases their impressions remain on the stones; but more commonly their substance is penetrated with earthy matter, and they are incorporated with the stone. They first appear in the transition class of rocks, and in them their forms are the most simple. Those in the oldest rocks, as limestone and slate, are chiefly molusca, as corals, ammonites, nautilites, &c. while vegetables seldom occur, except reeds and ferns.

In mountain limestone and red sandstone, the above are found, and more numerous vegetables. The coal formations abound in cacti palms, reeds, and ferns; the magnesian limestone, which rests on coal, contains numerous fish and amphibia.

The second sandstone contains both trees and shells. Lias and volite abound in bivalve-shells, spines of fishes, and bones of turtles, crocodiles, opossums, and fossil woods, besides ferns and reeds.

Fossil bones of the great mastadon, and other animals, have been discovered in the Birman Empire.

Fossil remains on the Ohio prove that it was once covered by the sea.

Caves full of bones of bears, hyænas, &c. have been found in Kent, in France, Yorkshire, Franconia, Italy, Somersetshire, &c.

On the descent of a sandstone rock, near Lochmaben, now hard, but then soft, there have been found, for forty or fifty yards, four tracks of animals, distinctly marked in uninterrupted continuity, with regular alternations of right and left foot and the heel and toes; supposed in one case to be the tortoise or crocodile: and the most distinct were on rocks sixty or seventy feet below the modern surface.

Under the ruins of an ancient town, near Modena, standing trees have been found, beneath these beds of shells, and beneath these vegetable remains. Ancient authors, Greek

and Roman, speak of many such discoveries in their time.

Trees are often found in Lapland and Siberia converted into iron ore and carbonate of copper. Lignites are petrified trees, in a state between peat and coals.

The most acute modern geologists agree in opinion that the vast beds of secondary limestone, and most of the secondary calcareous strata have been the production of shell fish and corals; and are distinct from the granite, gneiss, and their silicious and argillaceous ruins, which compose other strata.

Two caves full of bones have lately been discovered in France, and in one of them remains of rude pottery.

Insects are found perfect in amber and copal, which must have been of great antiquity. They afford new genera and species.

In the 13th and 14th century the face of Scotland, according to Tytler, was covered with immense forests of oak, filled with deer. Inverness, Elgin, Aberdeen, &c. &c. were covered with wood; and Stirling and Perth had extensive royal forests. The remains of large trees, of oaks, ash, beech, &c. are constantly found deep under the surface. Bears, wolves, wild boars, and bisons also abounded in them. Bears were extirpated in the 13th, and wolves in the 17th century. Beavers also abounded in the lochs.

In St. Andrew's Cathedral, used to be shown the remains of a wild boar, with tusks sixteen inches long and four thick.

Wood is found in Languedoc, part jet, part wood; and trees have been found converted into jet, but so entire as to distinguish their species, as walnut and beach.

In Zetland, twenty-four feet below the level of the sea dyke, there have been found turf, old alder, and other trees.

It is supposed that the bones of apparent birds, found at Stonesfield, &c. are pterodactyles, or extinct species of flying reptiles.

Ink bags, like those in the cuttle fish, are found in the lias at Lyme.

The bezoar stones found at Lyme, in lias, are the fæces of the ichthyosaurus. They resemble pebbles or long potatoes.

The dung of the sea-bird, the guana, on the coast of Peru, is a stratum fifty or sixty feet in thickness, somewhat similar to fossil coprolites.

The strata, near Reading, consists of a deep bed of clay, three feet of coarse fuller's earth, four feet of green sand, one and a half foot of sandy clay, two feet of oyster shells, one foot of sandy clay, thirty feet of chalk, and a bed of flint. In other places, fossil, shells, sharks' teeth, remains of fish, are found; and in others, bones of animals, and remains of birch trees.

On the shores of the Mersey, at Liverpool, at nineteen feet, was found fine sea sand; then a firm bluish marl intermixed with lichen, fibres, and leaves; then branches of trees; then trunks and roots of oaks, firs, &c., then marl, and at thirty feet a pair of stag's horns; then black peat, with nut-shells, fibres of timber, &c. a foot thick, resting on the rock forty feet below the quay, and twenty below the level of the pool.

Bullock describes a fossil lizard 150 feet long.

Ammonites, a univalve shell, is a very common organick remain, but not in existence as a living genus.

The molar tooth of a mammoth weighs 8 lb.; and the knob of the bone of the leg is a foot in diameter. It was a carnivorous animal, and the Indians have traditions of their terrible devastations.

A whole mammoth was found in 1806 *imbedded* within ice near the mouth of the Lena. It was nine feet high, and its horns weighed 400 lbs. The skeleton is now at Petersburgh.

Giant's bones 17, 18, 20, and 30 feet high are credibly reported to have been found; but there is now no doubt but they were organick remains of colossal quadrupeds.

In 1821 the bones of an enormous mammoth were found near Rochester.

Madrepore rocks are found in the

West India Islands on the highest primitive mountains.

There are beds of sea shells 2000 feet high, on Etna, and strata of gray clay, filled with shells much higher. The base is lava and marine substances in alternate layers; and beneath a stratum of lava is a stratum of rounded pebbles, while above it are calcareous eminences formed by the sea. A Sicilian canon who examined some of the beds of lava, separated by rich soils, has calculated that at least 14000 years have passed during their formation.

Thirty one great eruptions have occurred within the records of ancient history. Stones of immense size rise to the height of 7000 feet, and others fall 100 miles distant.

Volcanick action does not consist in the combustion of beds of coal, but in terrestrial operations seated deep under the oldest formations; and hot springs in Germany issue from gneiss, granite, and clay slate.

The Giant's Causeway is an assemblage of basaltick or volcanick columns a mile in extent.

The site of ancient Rome is on volcanick products, covering a marine formation.

At the Lisbon earthquake, Bristol Hot Wells became red. A well in King's Wood became black, and the Avon flowed back while rising.

Rounded pebbles are broken fragments of rocks, rendered smooth by mutual attritions, in long time, by water and tides.

The land in the northern is to that in the southern hemisphere as 16 to 5. The length of the old continent, taken from Behring's Straits to Cape Verd is 11000 miles, and from Cape Horn to Melville's Island is 9000.

The Amazon fall but a foot in 50 miles, or the Rhine one foot in a quarter of a mile, the Loire a foot in 1½ mile.

Fossil shells have been found on the top of the Pyrenees, and from 10 to 12000 on the Andes.

Ninety species of bones of quadrupeds have been found, which are now unknown.

About 200 active volcanoes are recorded, of which 89 are in islands. Submarine volcanoes often throw up islands. The Azores, the Lipari, the Canary Islands, &c. are examples. There seems no doubt but the same species of gaseous explosions, which cause volcanick eruptions, cause earthquakes, and these always accompany the activity of volcanoes.

All volcanoes appear to exist near a sea, and, by the matter they eject, to have some communication with it.

Volcanoes and tracts of land are often absorbed by the earth, and leave lakes in their places.

Professor Daubeny ascribes earthquakes and volcanoes to the access of water to the inflammable bases of the earths and alkalies, and this seems highly probable. When the explosion is single or double, and confined in a cavernous space, it is an earthquake; and when fed and supported by water, as in an elevation, it becomes a volcano.

A volcano, in 1815, in Sambawa, in the Indian Seas, shook the earth 1000 miles round. It filled the air with ashes 300 miles, and roared at that distance like thunder. Others, as Etna, &c. have been equally terrifick.

There is a regular current from the pole towards the equator, and in low latitudes from east to west. This general current being embayed in the West Indies, begets a returning stream called the gulf stream, which proceeds between the Bahamas and Florida, northward, at the rate of three or four miles an hour; and it thence passes to Newfoundland, and is reflected eastward to the Azores, and crosses the Atlantick to the Canaries; and thence joins the general current from east to west. Humboldt calculates that the same water is nearly three years in making this circuit of 10 or 11000 miles. A branch of it reaches the western coasts of Ireland or Scotland, and often brings West India products, wood, &c. which even reach Greenland, &c.

The gulf stream proceeding from the Tropicks, may be distinguished by its higher temperature. Its breadth increases from sixty miles, at lat. 28 degrees, to 150 at 33 degrees, and at 40 degrees it is 500 miles.

An upper current runs into the Mediterranean, and a south runs into the Baltic, on the Danish side, and a north one out of it on the Swedish side.

The waters of the Red Sea appear to be thirty-two feet higher than the Mediterranean, and the Gulf of Mexico is twenty-two or twenty-three higher than the Pacifick.

Sea-water appears to contain from 3.4 to 4 per cent. of salt. Its specifick gravity is 1.028.

In Icebergs only one-seventh is out of the water, and many are seen 200 feet high.

Lakes vary in size continually from desiccation, and the extinction forms basins of organick remains.

On low coasts, as in the Netherlands, and on the sandy mouths of rivers, the reaction of tides throws up the sand in hills or downs, often very high, and always increasing.

n two attempts to sound the Northern Ocean, with lines 1 mile and 1½ mile long, no bottom could be found.

The sands so much encroach on the western side of the Nile, that it covers once-flourishing villages, whose spires and minarets are visible through its surface. Probably the Oasis of Ammon was once part of fertile Egypt. The deluge of sand from the African deserts seems as fatal to the ancient world, as an irruption of the ocean, or the lava of a volcano, and it spreads with fatal certainty.

In general, the colour of the sea is a bluish green, lighter on the coasts. In the Mediterranean it has a purple tint. In the Gulf of Guinea it is white. Near the Maldives it is black, and in other places has red and yellow tints. Its component parts, with very slight variations, are water, muriatick acid, sulphurick acid, mineral alkali, sulphate of lime, and magnesia. The freezing point is 28½ degrees.

Springs of fresh water arise in most seas, and some on our coasts. Near Cuba there are remarkable ones.

About thirty fresh water springs are discovered under the sea on the south of the Persian Gulf.

The Mediterranean makes a tide of only one or two feet.

That singular natural curiosity, the floating island, has emerged from the bottom of Derwentwater three times in about thirty years. It contains about an acre and is quite stationary, and is entirely unconnected with the bottom and the shore; the soil is three yards thick. This floating island is not a solitary example. There is one at Lake Gerdau, in Prussia, and another at Lake Kolk in Osnabruck.

The Caspian is 306 feet lower than the Baltic, and 345 lower than the Euxine.

The salt lakes Aral, the Caspian and the Baltic were once connected, and perhaps the Caspian with the Persian Gulf, forming Homer's circle of waters, and bounding the then known world. Desiccation seems to be a cause always operating.

There can be no doubt but the Dutch provinces have wholly been formed by the mud of the Rhine, the Meuse, the Scheldt, and the Weser. So the Delta in Egypt, and perhaps all Lower Egypt has been deposited in like manner.

Lake Erie is rapidly filling with deposits. The lake of Geneva is contracting, and the lakes in Lincolnshire and Cambridgeshire have become dry in our days. The marine palace of Canute is now near Ramsey, twenty miles from the sea. Wales was anciently separated by an arm of the sea from the Bristol Channel to the estuary of the Dee and Mersey.

Springs are formed by the intervention of Clay and sand strata, the former holding water and the latter permitting its free passage. So that in well-digging, there is no water till clay is reached, or clay is penetrated quite through.

Berzelius thinks that all hot springs pass near a centre of volcanick action, perhaps long extinguished; he also thinks that the hot springs of Carlsbad are as old as the rocky formations. The river Tepel flows over their lid.

Two pounds of half-melted basalt raises 7 lbs. of water from 11 R. to 59 R., whence it is concluded that

mountains of heated basalt may maintain the heat of hot springs for many centuries.

No certain theory is formed on the cause of earthquakes, but the most general and rational ascribes them to steam and the force of gases formed by water and metallick oxydes.

In an eruption that happened in the year 1693, the city of Catania was overturned in a moment, and 18000 people perished in the ruins.

Fourteen earthquakes in different parts of the globe, were recorded in 1827, and perhaps this is an average number.

In Java, there are apertures in the ground which throw up mud in spherical masses, and have changed the face of their vicinity.

The Sandwich islands are volcanick, and Owyhee itself is the cone of a volcano higher than Mont Blanc.

There have been twenty-nine destructive earthquakes in Calabria since 1602, occasioned, as is believed, by the materials of a pent-up volcano, the vapours of which pass through the soil in fissures, cracks, and chasms. Animals buried under the ruins in the earthquake of 1793, were taken out alive in thirty or forty days and human beings survived after being buried twelve or sixteen.

In 1687, the sea retired from the shores of Peru, and returned in mountainous waves which destroyed every thing on the coast; among other places Callao. In 1746, the same phenomenon again took place, and only 200 out of 4000 inhabitants of Callao saved themselves,—nineteen vessels were sunk, and four, including a frigate, were carried over Callao into the country.

The Dead Sea or lake of Asphaltites, stands on the ruins of Sodom and Gomorrah, which were swallowed by one of those natural convulsions which have often visited these countries. It is sixty-five miles long and fifteen broad, strongly impregnated with minerals, though fish live in it. The specifick gravity is 1.24, and it contains 57.4 water, 24.2 muriate of magnesia, 10.6 of lime, and 7.8 of soda.

Near Linken, in a cave, rock crystals were found which weighed 4, 5 and 800 cwt. The exudation which forms crystals is a very extensive mode of rock formation in all varieties.

The Hindoos have a record translated by Wilford, describing a great churning, as they call it, of the sea, near the Hebrides, which lasted for months, and produced great changes. Perhaps it was a sub-marine volcano. The Irish chronicles record the separation of the Scilly islands, and there can be no doubt but the English channel was formed, and is still widening by the tides and floods which first opened it.

The cave of Staffa is made by the destruction of basaltick pillars by the sea. It is nearly 400 feet long, and 30 or 40 broad.

Bogs in Ireland are remains of fallen forests, covered with peat and loose soil, often forming hills. The quantity of rain in Ireland has added to this feature of all countries. Moving bogs are slips of these hills carried to lower levels by accumulating water.

It seems, on the evidence of Seitzen, Gray, and Ehrenberg, that a sand hill on mount Sinai, called Nakato, by continual falling produces remarkable tones, like an Æolian harp, a murmuring noise like a distant cannonade, and greater at certain times.

Sand floods are frequent near sea shores where the wind carries the sand on the beach, and thence over the land. In Africa, vast tracts of native sand are thus carried over adjoining districts and have gradually encroached so as to threaten all Egypt with their sterility, having, since the Christian era narrowed the valley of the Nile as well as the northern states of Lybia, Cyrene, &c. while the sands of Arabia have encroached in central Asia. These sands float like waves before the wind, and at a distance resemble the surface of the sea, while tornadoes in them are fatal to travellers.

The general changes on the earth appear to arise from astronomical causes, the progression of the line of Apsides and the diminution of the obliquity; and local changes arise

from water in rivers, rain, and tides; from accumulated vegetation, from decompositions, earthquakes, and volcanoes.

HEAT.

Heat or varied temperature, and its different effects on different substances, with their varied powers of receiving and transmitting it, afford not only of themselves prodigious number of curious phenomena, but are the immediate causes of nearly all those phenomena of nature which are connected with the expansions, condensations, changes, and conversions of bodies. There can be little doubt that heat is itself a mere effect of motion, and that various intensities by percussion or motion applied, transferred to various atoms and to various combinations, is the cause of all the phenomena of heat. Varied exhibitions of heat in different bodies, seem to arise entirely from that greater or less susceptibility to motion of the atoms which compose them. If a body displays great heat with less excitement, it seems to be solely, because the atoms are so combined as to be more or less susceptible of excitement; and if the term *Calorick* is used for heat, it can properly be used only in that sense.

Count Romford, by boring a cannon within water, so heated it by the friction, that he made it boil, and actually boiled a piece of beef in it.

Blacksmiths commonly light their matches by giving a nail five or six strokes with a hammer. Most savage nations produce fire by rubbing two dry sticks together.

In boring cannon within water, the temperature of nine quarts, was raised from 60 to 170 deg. in an hour, and in two hours and a half the water boiled, the whole heat being equal to what would have been produced by nine wax candles burning the same time.

In strong percussions, the first blow produces the greatest heat and the greatest change in density; thus, in coining copper at 8.85, the first stroke renders it 8.89, with an increase of heat of 10 deg., but the second stroke makes it only 8.91, with 4 deg. of heat.

Different degrees of excitement of their atoms leave their bodies in a state of solidity; other proportions break up their solid structure and convert or melt them into fluids; and higher proportions expand them into vapours and gases. On the contrary, diminished excitements reduce the gases and vapours to fluids, and the fluids again into solids. In this way Mr. Farraday has condensed even the permanent gases into liquids.

Cold is the mere absence of the motion of the atoms of the substance called heat, or the abstraction of it by the evaporation of atoms conveying away the motion, or by the juxtaposition of bodies susceptible of motion, but not previously moved. Cold and heat are mere relations of fixity and motion in the atoms of bodies.

Dr. Black advanced a hypothesis that imagined that heat was a property of certain atoms, which moved from one body to another, and when not in motion, were *latent* in the bodies. This idea has prevailed for half a century, and the name of these atoms is called CALORIFICK.

It appears that the susceptibility, or inherent latent heat, is in certain various proportions, whether considered as a susceptibility of excitement in the atoms of the body, or as heat itself in a latent state: but as this last is a gratuitous property, it has, in general, ceased to be insisted on, as leading to many mistakes in reasoning and practice. The susceptibility, or specifick heat, has been determined for every kind of body by the labours of chymists during the last fifty years. WATER is taken as 1; then HYDROGEN GAS is 21 by Crawford and 9.4 by Dalton. OXYGEN at 4.7 by Crawford and 1.3 by Dalton. AIR 1.8 by both. AZOTE 0.8 by Crawford and 1.8 by Dalton. Aqueous STEAM 1.55 by Crawford and 1.17 by Dalton. ALCOHOL, by several averages, 0.8. LINSEED and WHALE OIL 0.5. Arterial blood 1.03, and venous blood 0.89. Farinaceous substances 0.5 and 0.4. Pit coal 0.28. Cinders 0.19. Glass 1.9. Iron 0.12 Silver 0.08. Gold and lead 0.05. The varied susceptibility is proved by mixing the same quantity of fluids at

the same temperature; thus, if oil at 50 be mixed with water at 100, the result in heat is 83⅓, and not 75 deg.

Whenever liquid is converted into gas or steam the gas or steam carries off the motion and therefore produces coldness. Hence damp bodies are cooled under an air pump, as is well known.

In proportion as any thing expands, as the expansion is the effect of motion, so the expansion demands motion and occasions evaporation, which occasions more cold. Hence the rarefaction of air occasions cold, because the same atoms by mere motion fill a larger space. Hence, when air is halved in an exhausted receiver, the hydrometer sinks fifty degrees, and if suddenly reduced to a sixty-fourth, it sinks 300 degrees before moisture expands to fill up the vacuum. Leslie's very ingenious discovery consists in absorbing the moisture by a saucer full of oil of vitriol, and thereby have the expansion without the moisture. When the air is rarified 250 times, water under the receiver is cooled down 120°; and at the usual proportion of fifty times to eighty or 100°. In this experiment, the motion which kept the water liquid is transferred to the heated sulphurick acid. The water then fixes or crystallizes, but if left in the rarified air it entirely evaporates after it has become ice.

Water freed from air or its more mobile atoms by boiling, should be close stopped in a bottle if proposed for experiment. Sulphurick acid or parched oatmeal is capable of congealing forty times its weight of water, with rarefaction from twenty to forty. Mercury is solidified in the same manner so as to bear the stroke of a hammer.

In Bengal, the Hindoos make ice by evaporation, and ice-pits for use in hot weather. The Hindoos also cool water by mixing one part of nitre with two of water. Chymists have ascertained that nitre and sal ammoniack, or nitrate of potash and common salt, in equal parts, added to three parts of water, sink the thermometer 40 degrees; and also, that three parts of the phosphate of soda and two parts of nitrate of ammonia, combined with one part of weak nitrick acid, will sink the thermometer 71 degrees.

Leslie, to increase the dryness of air, employed flannel, powdered trap, dried oatmeal, also oil of vitriol; then, by suspending water in a porous vessel over these substances, they kept the surface dry, and increased the evaporation and coldness to 60 degrees. He also froze water under the receiver of an air-pump, by placing under it a vessel full of oil of vitriol, and the acid will absorb half its weight of water. It appeared that when the air was withdrawn from the receiver, water under it parted with its air, and this being absorbed by oil of vitriol, or parched oatmeal, the water freezes. The degree of cold which is thus produced sinks the thermometer 180 degrees.

Combustion arises from the motion created by oxygen gas, being imparted by the combination of the oxygen with the burning body, which usually consists of excited hydrogen in connexion with some substance, usually carbon. A preliminary excitement generates the hydrogen, with which the oxygen in the air immediately combines, parting with its motion, which motion heats the carbon. The flame and light is an intense excitement, which necessarily radiates from the place of flame, and depends, in colour, on the third substance with which the hydrogen was previously combined. These appear to be the instruments of fire, flame, and light. Oxygen is, therefore, called the supporter of combustion; and other bodies are so called, owing, probably, to the oxygen which they contain, or which, being fixed in like manner by excited hydrogen, part with the previous motion. The products of this union or combustion are water, carbonick acid gas, and, when metals are consumed, a calx or oxyde, which is heavier than the metal by the quantity of oxygen which has been combined. The hydrogen evolved by the first and continued excitement is called the *inflammable gas;* and, perhaps, no combustion takes place without it in greater or less proportion. Bodies which do not contain it, as stones, bricks, &c., are incombusti-

ble. Flame, fire, &c., are, therefore, mere effects of the union of two gases, or the same when other bodies are used.

If heat is atoms in motion, then gas is atoms in motion; and the formation of gas absorbs motion or heat, while the condensation distributes it. This theory accords with all phenomena, on nearly the same reasoning as the assumption that heat is a peculiar matter called calorick.

The coarse mechanical methods of exciting heat are called percussion and friction; thus, a hammer struck on metal, or any hard body, makes it hot, but if struck on a friable noncohering body, which yields to the velocity and disperses by the blow, no heat is produced. The heat produced by friction is well known to all mechanicks, and is diminished either by making the surfaces smooth with unctuous substances or by water, which evaporates, and carries off the excitement.

The cause of all inflammability is hydrogen; and in other words, inflammability means nothing more than the fixation of oxygen gas (the atoms of which were previously in intense motion) by hydrogen gas, whenever hydrogen gas is evolved and also excited. Tallow, wax, oil, and alcohol, contain hydrogen; and to light them we apply a burning body, by which means the hydrogen is evolved, and excited to 800 degrees and upwards; so that the oxygen of the air unites, and parts with its previous motions, by which motions the excitement of the hydrogen is continued at 800 degrees and more.

The burning, or decomposition and composition, continues as long as the substance affords hydrogen, and the supply of oxygen is of course indefinite. The products are soot and carbonick acid from the carbon and oxygen; water from the hydrogen and oxygen: and the excitement around, called light, is the result of the whole.

Gas, or aqueous vapour, is formed in the simplest manner, by striking a piece of iron some quick blows with a hammer. The momentum of the hammer is thus transferred to the atoms of iron, which, by reaction from their sub-parts, radiate invisibly, and the iron affords, as a result, the sensation of heat, which continues till the momentum imparted has been radiated. If then some water, which radiates better than iron, is put on the iron, the water is dispersed in steam or separated atoms. These emerge into a space filled with aerial atoms, and suffer constant deflections in every direction, which ultimately produce small circular orbits in each atom, while the aggregate produces a cloud of steam, which continues till the motions have been parted with, when it is precipitated as water. The motions of the hammer are thus in the steam. All other gas is virtually or actually made in the same way, and the volumes depend on the excitement, and on the bulk and form of the atoms affected.

As heat is the motion of atoms, so its communication enlarges bulks; 180 degrees of heat expands 100 cubick inches of air to 137 inches, and other gases in nearly the same proportion.

This effect of expansion is the foundation of the thermometer; different degrees of excitement swell it and contract it; different makers mark their scale differently. The freezing point of Fahrenheit, the most common, is at 32 degrees, and boiling water at 212 degrees. Mercury, however, expands more at high degrees than low ones; and, therefore, the midway between freezing and boiling is at 110 degrees instead of 122 degrees. Mercury is preferred because it does not freeze till 40 degrees below zero.

Mercury expands between 32° and 212°, 0.02 to 0.018; water 0.0433; fixed oils 0.08; alcohol 0.11.

100 parts of air at 32° expand at 40° to 101⅔; at 50°, to 103¾; at 60°, to 105.8; at 70°, to 108; at 80°, to 110; at 100°, to 114; at 120°, to 118; at 150°, to 124½; at 200°, to 135; and at 212°, to 137.4.

The second's pendulum, of 39.139 inches, is lengthened by 30° of temperature the 128th of an inch, or eight vibrations in twenty-four hours.

As much heat, or atomick motion, is imbibed by a pound of ice in melt-

ing, as would raise a pound of water to 135 degrees. Black made it 140 degrees, which, multiplied by ten, as the whole quantity of heat in water, at 32°, gives 1400° as positive zero, when no heat would remain. Crawford made the absolute zero 1532°; Gadolin made it 1432°; and La Place 3460°; while Desormes makes it only 448°.

Pieces of ice rubbed together melt. Pieces of brass rubbed together in an air-pump, become hot; and a vacuum transmits heat, owing to the radiation of the atoms of the substance which encloses it.

The metals which retain heat the longest are brass and copper, then iron and tin, and lastly, lead.

Taking the heat-conducting power of water at 10, ash is 81, elm 32, oak 33, and fir 39.

The densest woods are the best conductors of heat. Hornbeam (4 inches 10 lines long and 1 inch thick) conducts 54 deg.; oak 50.5, Chestnut 53.7, Fir 47.91, Poplar 37.59, and Cork 17.5.

The best conductor of heat, or most excitable of the metals is silver; then gold, tin, copper, platinum, steel, iron, and lead. Hare's fur, cider down, wool, and silk are the worst conductors.

The safety lamp is founded on the principle, that flame in passing through iron-wire messes, loses so much of its heat as not to be capable of igniting inflammable substances around, while flame only ignites gas. There ought to be above 625 apertures to the square inch. A pin stuck in a rushlight extinguishes it on the same principle of conveying heat from the wick.

The absolute quantity of atomick motion, or calorick, as it is called, in water, at the freezing point, is taken by Black at 1400 degrees, below which no heat would remain. Crawford made this zero of water 1532 deg.; Gadolin 1432; Lavoisier 3460; and Dalton 4, 5, and 6000.

The intense motion which exists in atoms when gaseous, is proved by the recondensation and in this way the condensation of muriatick acid gas has transferred its own intense motion so as to make mercury boil at 656 deg.

Ether boils at	104 deg.
Alcohol	173.5
Nitrick acid	210
Water	212
Oil of turpentine	304
Sulphurick acid 1.8	472
Phosphorus	554
Sulphur	570
Linseed Oil	640
Mercury	656

That is, they cannot be made hotter, and their steam, which equalizes their heat, then balances the atmospherick pressure at 30 inches. Taken then as to the force, the steam at lower temperature has less elastick power. Vapour of ether at 64 deg. has a force only of 13 inches of mercury, but at 210 it is 166. So alcohol at 55 deg. has a force of only 1, but at 200 deg. it is 53; and at 264 deg. it is 166. Turpentine at 350 deg. is 53.8; and at 362 deg. is 62.4.

Quicksilver melts 39 below zero.

Ether freezes 47 below zero.

Cold from sulphurick acid and snow 78.5 below zero.

The greatest artificial cold ever produced was 91.

Equal parts of alcohol and water freeze at 7 deg. and two of alcohol and one of water at 11 below zero.

Wine freezes at 20 deg.

Iron is a bright red at 752 deg.

Lead melts, 594 deg.

Bars which are 1 at 32 deg. expand at 212 deg. as under:—

Glass becomes	1.0008¾
Platina	1.0009
Cast iron	1.0011
Steel	1.0018
Iron wire	1.0014
Gold	1.0015
Copper	1.0017
Brass	1.0018
Silver	1.0020
Tin	1.0028
Zinc	1.0029

The following table exhibits the exact expansion of various substances between 32 and 212 deg. of Fahrenheit in parts of an inch:

Glass	.0097
Steel	.0137
Iron	.0151
Copper	.0204
Brass	.0225
Pewter	.0274

Tin	.0298
Lead	.0344
Zinc	.0353

Wedgwood's Pyrometers consist of small cylinders of porcelain clay which permanently contract at great heats, but uncertainly. His scale commences at 1077 deg. of Fahrenheit, and the following table expresses some of his results:

	Wedg.	Fah.
Brass melts	21	3807
Silver melts	28	4717
Gold	32	5237
Flint Glass	114	15897
Plate Glass	124	17197
Cast Iron	150	20577
Nankin Porcelain softens	160	21877

A platina pyrometer gives different results; by it the degrees are as under:

Silver melts	1823 Fah.
Gold	2518
Cast iron	8696

By this platina scale it appears that mercury boils at 643; zinc melts 705; Copper 2205; platina 11454.

By other experiments of Mr. Daniell, he makes brass melt at 1869; silver 2233; copper 2548; gold 2590; and cast iron 3479, which last, Wedgwood made 20577. Mr. Daniell also makes the heat in a parlour fire 1141.

Roy, with Ramsden's microscopick pyrometer, determined the expansion of brass from 32 to 212 on a foot, to be .0227 of an inch; on steel to be .0137; on cast iron .0133; and on a glass rod .0097.

The absolute heat, motion, or caloriek, in equal bulks of water and mercury, is as 28 to 1.

Equal weights of water at 32 and 212 deg. give 119 deg.

Thermometers vary from true heat. 51.26 deg. of true heat gives 50 of Reamur, and 47.3 by alcohol; and 21.12 gives 20 by Reamur, and 16.5 by alcohol.

Light matches are made of three parts of chlorate of potash and one of sulphur or sugar, made into paste with gum water. The matches are dipped in this paste, and when touched with sulphuriek acid in a bottle, they flame.

The human body, in a healthy state, is generally at 98° of Fahrenheit. Artificial hot baths are generally 6 or 7° higher. The king's bath, at Bath, is 116°; the hot bath 117°; at Vichy 120°; at Barege 122°; Borset 132°; Aix-la-Chapelle 140°; Carlsbad 165°; Baden and Pisey 104°; Buxton 82°; Bristol 74°; Matlock 66°. Sea water is seldom below 40°; springs about 45°; and pools and small rivers are at the temperature of the atmosphere.

The heat of an oven applied to a dead human body for twelve days, reduced it from 120 to 12 lbs. The fluids are to the solids as eight or ten to one.

Blagden and others in heated rooms at 280° experienced no inconvenience in respiration, and the heat of their bodies did not rise above 99½°. Chabert entered an oven at 500°. But all metal acquired the full heat; water boiled, &c. Fish too actually live in hot baths up to 158°. Trees also grew in a bath at 174°; flowers, near a volcano at 210°; water plants are found in boiling springs.

By atmospheriek and solar heat a sun-flower weighing 3 lbs., loses or changes 22 ounces in 24 hours, and a man 2 lbs. by animal heat.

Newton considered flame as red-hot smoke; but modern science regards it as the place where oxygen unites with hydrogen and carbon, and the diminution of volumes transfers an atomick excitement to the carbon, which radiates or protrudes light; the fixation of the gases causing the heat as long as hydrogen is evolved. All flame, in fact, is produced by the union of the hydrogen of the combustible and the oxygen of the air acting on carbon.

Brown's gas-steam-engine, worked by consuming carbonick oxyde, produces a pressure of 22 inches of mercury, or 11 lbs. to the square inch, or a working pressure of 10 lbs.

When steam is first generated, by water at 212 deg., its force is that of one atmosphere, its density 1, and its specifiek gravity 1.26; but at 320 deg. its force is equal to six atmospheres; at 358 deg. to ten; at 416 deg. to twenty; and 590 deg. to one hundred atmospheres. The different force is created by the principle of heat, which is so much atomick mo-

tion transferred to the atoms of water, by which their orbits are enlarged at every increase, and the expansive power increased, as the orbits of the atoms enlarge.

Separation of fluids by distillation and by cold illustrates the prineiple; and the demands of motion or heat from surrounding bodies during all expansions, and its radiations during condensations, are other illustrations which run through all chymistry.

Steam at 212 deg. has the force of the atmosphere, and is 3000 times rarer than water, or 3½ times rarer than air; and great heat will raise it to 14000 times the bulk of water, equal to five atmospheres. Taking 212 as 1, its force at 100 is .062; at 260 is 2; at 290, 3; at 300, 3.337; and at 330, 4.6.

Elastick fluids expand equally with equal increase of temperature.

A cubick inch of water, ther. 40 deg. may be expanded at 212 deg. to 1694 inches, when its elastick force is equal to that of the atmosphere.

The force of steam is in geometrical progression of the temperature.

A bushel of coals will convert into steam fourteen cubick feet of water, occupying 1330 times that space as steam, and lifting the atmosphere above the water 1330 times its depth, or 39 millions of pounds one foot high, or with deductions 30 millions; susceptible of further increase by more fuel, carrying it above 212 deg.

In a steam-engine every nineteen cubick inches of water produces twenty feet of steam, or 1 to 1800 nearly; and this is equal to one horse, and produced by a quarter of a pound of coals. In general, a chaldron of coals works a hundred horse power for four hours.

One cubick foot of boiler in steam pipes heats 2000 feet of air 70 deg.; and one square foot of pipe will warm 200 feet of air.

Watt's improvement of the steam engine consisted in his discovery of the power of cold water to condense steam; and he, therefore, applied this neat means instead of allowing the steam to escape, as in the old engines.

Four ounces of water will, in a second, condense 200 feet of steam, and reduce its expansive force to $\frac{1}{5}$.

If heat is the motion of atoms, then, as all gas is formed by abstracting or absorbing heat, while atoms are dispersed, so *animal heat* is an immediate sequence of the respiration of aerial gas, and animal energy also. Thus a man consumes 330 cubick inches of air in his twenty ordinary respirations per minute; and the 28 cubick inches of its oxygen becomes carbonick acid gas, whose specifick heat is reduced $\frac{1}{3.5}$. This is 1728 inches in 61 minutes, containing 876 deg. of absolute heat; and an absorption of 876—195=681 deg. of absolute heat or motion is therefore fixed in the system. In exertions, it is doubled or trebled in quantity.

One gallon of water in steam will raise six gallons from 50 to 212.

4 lbs. of beef loses 1 lb. by boiling, 1 lb. 5 oz. by roasting, and 1 lb. 3 oz. by baking; 4 lbs. of mutton loses 14 oz. by boiling, 1 lb. 6 oz. by roasting, and 1 lb. 4 oz. by baking.

Lamps were used by the ancients, and candles were an invention of the middle ages. At first, wicks were made of hemp, papyrus, and the pith of rushes. Ox and sheep tallow is now preferred. Tallow melts at 92 deg., spermaceti at 133 deg., and bleached wax at 155 deg. Wax candles are made very cheap in America, from the berry of a particular species of myrtle, which yields excellent wax, of a green colour. They may also be made by mixing wax with the pulp of potatoes, and also of the butter of the cocoa-nut, and these are excellent.

A gas-light equal to one good candle consumes 1.43 of cubick gass per hour; four candles 1.96 per hour; six candles 2-$\frac{4}{10}$; eight candles 2.95; and ten candles 3 feet.

One lb. of hydrogen consumes or fixes 7½ lbs. of oxygen, which melts 320 lbs. of ice. A lb. of wax, oil, or tallow consumes or fixes 3 lbs. of oxygen, which melts 104 lbs. of ice.

Scotch canal coal produces the greatest proportion of illuminating gas; then Wigan, Wakefield, Staffordshire, Dean Forest, and Newcastle.

A chaldron of coals yields 10000 cubick feet of gas. Street lamps consume 5 feet per hour, and Argand lamps 4 feet.

16000 cubick feet of gas are obtained from a chaldron of Newcastle coals, or 590 per cwt. 11000 cubick feet are produced by a chaldron of Staffordshire coal, or 400 per cwt.

Gas-pipes of half an inch in diameter supply a light equal to 20 candles, one inch 100, two inches 450, three inches 1000.

The gas which lights London is made by four companies, who consume 34000 chaldrons of coals per annum, which make 400 millions of cubick feet of gas, lighting 62000 indoor and 7500 street lamps. Various establishments make one-eighth more.

The gasometers of the London gas companies contain each nearly 20000 cubick feet of gas, and some have 47 of them ; and altogether 1315 retorts. The coals make one-fourth more in bulk of coke, which sells at about 20s. the chaldron.

Sixteen retorts will produce daily 50000 cubick feet of gas, consuming five tons of coals in the retorts, and costing above five farthings for every ten cubick feet of gas; while it is computed that this will give as much light as half a pound of candles. The same quantity of oil gas would cost 2½*d.*; while the refuse in making the coal gas is worth a fifth.

In 1830, the gas-pipes in and round London were above 1000 miles.

Water in freezing evaporates as much as by direct heat, and ice evaporates largely. As evaporation carries off the most mobile atoms, or calorick, it produces coldness in the body.

Fordyce, Morveau, and Romford, proved that when the atoms of fluids become fixed by freezing, they increase in weight; lateral motions of fluidity, diminish weight. Davy and Berzelius state that the weight of an atom of azote is twice its specifick gravity.

The bulb of a thermometer, covered with cotton, and moistened with ether, may by the evaporation be reduced far below zero.

Three parts of snow and four of potass, or two parts of snow and three of crystallized muriate of lime, produce 83 deg. of cold.

Two parts of common salt mixed with two of ice or snow produce a degree of cold five degrees below the zero of Fahrenheit. One of sal ammoniack and two of common salt with five of snow, make it seven degrees colder. And equal parts of nitrate of ammonia and common salt with two and a half of snow, reduced it 25 degrees below zero. Five parts of muriate of lime and four parts of snow freeze mercury. If the muriate of lime be crystallized, or four parts of dry caustick potash be added to three of snow, fifty degrees below zero may be acquired. Mr. Walker of Oxford produced ninety-one degrees, by applying two parts of sulphurick acid to snow. The whole arises from the transfer of the atomick motions of the adjacent bodies to effect the melting of the snow, and the cold is inversely as the time in which the melting is effected. It is a case of the transfer of motion.

Salts in water, lower the freezing point. Thus, 25 per cent. of common salt in water lowers its freezing point from 32 degrees to 4 degrees, but other salts less. Hence, water frozen at 32 degrees, is liquefied by 25 per cent. salt, till the thermometer falls to four degrees, and in proportion for other quantities of salt.

Acids and salts absorb moisture, and as they and the water freeze at different degrees, freezing decomposes them, while the temperature in connexion, occasions the water not to freeze at 32 degrees. Sea water, therefore, does not freeze so soon as fresh water, and 25 per cent, of sulphurick and nitrick acid lowers the freezing point of the mixture to 7.5 and 7. When snow or pounded ice are mixed with salt or the acids, these dissolve the solid crystals into fluids, and in converting solidity into fluidity withdraw motion from surrounding bodies so as in them to be capable of producing a cold of 70 degrees below *zero*.

All hot bodies distribute their heat or atomick motion to other atoms around, and this depends on the roughness of the surface, as exposing

the greatest number of points to surrounding atoms. Metal, paper and glass radiate the least; lamp black the most.

A thermometer fell from 190 to 68 degrees in a vacuum in ten minutes, but in air in six minutes. Two tin globes, one painted lamp black and the other bright, the first lost half its heat in 35 minutes, and the other in 44 minutes.

If the surface of the metals is scratched or roughed, the radiation, of course, is increased, because the excited atoms which cause the heat have more points for distribution to the atoms around. Some of the proportions are lamp-black 100, ice 85, polished iron 15, gold, silver and copper 12. Reflection in right lines, has contrary power to distribution or radiation by contact, and in this last case it is of course diminished by rarefying the medium.

Heat does not pass through bodies till it has heated them or put their atoms in uniform motion. Some bodies are more susceptible or contain more susceptible atoms than others. Silver and gold, copper and tin, are among bodies the most susceptible of atomick excitement, and conduct what is called heat the best; other metals have less facility, stones less than metals; brick, glass, dried woods, and charcoal less still; feathers, silk, wool, and hair, least of all bodies. This list proves that the conducting power is an effect of the continuity of the matter, and is less as the interstices between the atoms are greater. Liquids are dispersed by the heat, and therefore bad conductors. Gases are enlarged by it, and therefore it is exhausted in themselves.

Taking the radiating power of lamp black at 100 seconds, ice is 85 seconds, lead 19 seconds, iron 15, and tin, gold, silver, and copper 12.

The invisible radiations from heated bodies may be acted upon by refraction and reflection like light, but they do not pass through transparent bodies.

A poker laid over a fire, concentrates the heat of the passing smoke, and creates a draught through the fire.

Wheels and casks are bound by hoops, swelled by heat, the contraction rendering them more binding.

A thermometer, at a certain elevation, cooled in air, azote and oxygen in 100 seconds, in hydrogen in 40, in coal-gas in 70, and in carbonick acid in 112.

Argand's lamp carries a current of air through the wick, by which more oxygen is fixed.

If oil at 100, is mixed with water at 50, the result is 66⅔. Hence, water is conceived to have double the susceptibility or power of receiving heat that oil has.

When water freezes it forms itself into crystals with interstices, and expands: hence, ice swims, and is eight parts in one hundred lighter than water. Some metals and sulphur also expand when crystallizing, while other bodies contract. Salt water does not freeze till four degrees lower.

A volume of ice is melted by as much heat as will raise an equal bulk of water 140 degrees.

A cubick foot of oxygen imparts 876 degrees of heat.

Though lead melts at 540 by itself, bismuth at 460, and tin at 408 degrees of Fahrenheit, yet if mixed in the proportions of 5, 8, and 3, they melt at 200 degrees.

Phosphorus smokes and becomes luminous at 43 deg.; at 99 it melts, and at 219 evaporates. As friction kindles it, so a match thrust into a box of it, combined with sulphur or lime, takes fire. All luminosity of insects, &c. arises from secretion of phosphorus.

Animals die if their vital temperature is increased one-twelfth.

Hemp, cotton, matting, &c. with oil and lamp-black, generate heat, and finally ignite spontaneously when exposed to air.

In flint and steel, the intense excitement of the steel occasions the particles to take fire, i. e. hydrogen is excited and oxygen combined or fixed, which is the universal characteristick of flame and luminosity.

The compression of water by thirty atmospheres gives out the sixty-sixth of a degree of heat.

Equal volumes of all gases have

the same specifick heat; but each gas has a different conducting power.

Melted snow produces about one-eight of its bulk of water; hence snow, two feet deep, produces three inches of water when thawed.

In Cornwall, certain steam-engines have lifted 40 million pounds one foot, with one bushel of coals; and one at Wheel Towan lifted 62 millions with an 80-inch cylinder.

Frost proceeds downwards, heat upwards.

As heat rises with the rarefied air, Count Rumford taught to place grates low, to make chimneys small, and mantle-pieces low.

The heat making atoms which evolve from an iron-stove at a black heat, are visible in a sun-beam in a dark room.

A naked body in air cools in 576 seconds, in wool in 1118 seconds, in cotton in 1046 seconds, in hare's fur 1315 seconds, in raw silk 1284 seconds, and in cider down 1305 seconds.

Water saturated with nitre loses 17 degs. of heat, and with nitrate of ammonia 46 degs. of heat.

All solid bodies become luminous at 800 degs.

Extreme cold produces the same perception on the skin as great heat. When mercury is frozen at 40 deg. below zero, the sensation is the same as that of touching red hot iron.

Acids combine with water, condense it, and produce heat.

One gallon of water converted into steam will heat six gallons at 50 deg. to the boiling point; and one foot of surface of cast iron steam pipe will heat 200 cubick feet of air 70 degs.

Fourier calculates that the celestial spaces are 58 deg. below zero.

Eggs are hatched at 104 deg. of heat.

Iron is melted by heated air, with three-fourths of the coals.

When a bulk of lime and water are combined, the heat is caused by a condensation equal to the bulk of lime, for the mixture is the same bulk as at first.

Sir Charles Blagden exposed himself in an oven heated to 250 deg. for eight minutes without injury. A vapour bath cannot be endured at 120 deg.

Steam at 32 deg. has a force of 2; at 80 deg. of 1; and 120 deg. of 3.3; at 212 deg. of 30; at 220 deg. of 40; at 300 deg. of 140; and at 312 deg. of 167.

Water boils at 187 deg. at the top of Mont Blanc.

The coldest hour of the twenty-four is five in the morning, and the warmest is from two to three in the afternoon. The mean heat is from half-past eight to half-past nine. The greatest range is in July, the least in December.

At Bear Lake, Captain Franklin, on February 7, found the thermometer at 58 degrees below zero, and for two days it had been 57.5 deg.

A convex lens burns at 25 feet under the surface of the sea in a diving bell.

Count Rumford gave 1000*l*. 3 per cent. annuity, the interest of which is to be disposed of every other year to the person who shall communicate any discovery on heat and light. The preference to be given to such discovery as tends most to promote the good of mankind; and to be determined by the council of the Royal Society.

Combustible bodies will not burn if dipped in a solution of potash, or phosphate of lime, or muriate, sulphate, and phosphate of ammonia, with borax. The alkaline substances arrest the hydrogen, or prevent its combination with oxygen.

In Siberia and Hudson's Bay, mercury sometimes becomes solid, proving the cold to be 39 deg. below zero. Wine and spirits also becomes a spongy mass of ice, and the freezing of the sap in trees and of water in rocks explodes them.

Humboldt, La Place, &c. consider the fact of an internal heat in the earth as fully established, and they ascribe to it the origin and phenomena of volcanoes in connexion with metallick bodies, and the access of water to supply oxygen and hydrogen.

At eight feet deep the annual temperature varies only from five to se-

ven degrees; and at four feet, from ten to twelve degrees; while at one foot, it ranges from nineteen to twenty degrees; and in the open air, from 50° to 65°.

At the depth of forty or fifty feet the temperature of the earth is the same in winter and summer, apparently colder in summer, and warmer in winter. Frost seldom penetrates above a foot into the ground.

The earth is believed to increase in heat, a degree in every fifteen or twenty yards depth. *Cordier.*

In the catacombs at Paris, the thermometer through the year, is from fifty-two to fifty-four degrees, while on the surface it varies from ninety degs. to 0 deg. In Mexican mines it stands at seventy-four degrees.

Depths of undisturbed air are like water. In a silver mine in Norway, 300 feet deep, the bottom is covered with snow, and so in other deep caves, owing, as is believed, to the cold air of winter sinking to the bottom.

While air above snow is seventy degs. below the freezing point, the surface of the ground below the snow is only 32 degs.

At great depths in the sea, as 4000 feet, the difference is from fifteen to twenty-two degrees between the air and the water at that depth; and at 4680 feet the water is twenty-six degrees, while the air is 48½°

Near Jamaica, at the depth of 6000 feet, the thermometer fell from eighty three in the air to forty-five in the sea.

It has been proved by experiment in lat. 56 deg. 10 min., by keeping thermometers fixed in the ground at various depths, that frost does not penetrate so deep in the earth as a foot; that at the depths of one, two, and three feet, the lowest temperature, during two years, was, at one foot, 33 deg.; at two feet, 36 deg.; and at three feet, 39 deg.; while the highest was at one foot, 35 deg; two, 52.5°; and three, 52 deg.

The lake of Geneva, at the depth of 1000 feet, is always 42 deg. and no variation takes place below 160 feet. In a lake near Rome, at 490 feet, the thermometer was 44½, though at the surface it was 77 deg. Variation does not take place below 120 feet. In Scotland, on the surface of Loch Lomond, the thermometer stood at 59.3, but at 90 feet, it fell to 43.7, and at 240, was 41.3; and at 600 was 41.1.

The deepest coal mine in England is at Killingworth, near Newcastle. The annual temperature at the bottom, 400 yards below the surface, is 77 deg., and at 300 yards, 70 deg.; while at the surface it is but 48 deg., being about 1 deg. for every 15 yards. This may explain the origin of hot springs, for at 3300 yards the heat would be equal to boiling water, taking 20 yards to a degree. The heat of the Bath waters is 116 deg., hence they would appear to arise at 1320 yards below.

The mean annual temperature at the level of the sea, is for different latitudes, as under, and the third column shows the height in feet of constant freezing in those latitudes.

	deg.	feet
Equator . . .	84.2	15000
lat. 10	82.6	14700
20	78.1	13300
30	71.1	11500
40	62.6	9000
50	53.6	6300
60	45	3800
70	38.1	1700
80	33.6	450

The heat may be supposed to arise from the verticity of the sun in the tropicks, and then dispersed through the mass, but finding a limit by dispersion in the annual orbit.

Of 10000 rays falling perpendicularly, 8100 reach the earth; 7000 at 50 deg., 2800 at 7 deg., and 5 at 0 deg.

Water seldom freezes till the meridian altitude of the sun is less than 40 deg.

In the latitude of London, America is 13 deg. colder than Europe, and in 40 lat. is 8.6 deg. colder than Europe.

In China and Africa, the thermometer rises to 110 and 113, and even to 125 deg. in the sandy deserts; and in Hudson's Bay it falls to 50 and 55 deg. below zero.

When the sun is in Aries or Libra, the relative heat of the equator, according to Humboldt, taken at 1000;

at 20 deg. is 940; at 40 deg. 760; and at 60 deg. 500. But when in Cancer, or Capricorn, is for the same hemisphere at 0 deg. 9117; at 20 deg. 1008; at 40 and 50 deg. 1150; at 70 deg. 1175; and at 90 deg. 1250; owing to sunshine for six months.

The temperature in equal latitudes, is from 4 to 8 deg. less in the southern hemisphere, supposed to arise from the extended surfaces of water, and from the sun passing through the southern signs in 7¾ days less than the northern.

A condensed mixture of oxygen and hydrogen, in the proportion of water, passed through a pipe, constitutes the oxy-hydrogen blow-pipe, producing unprecedented degrees of heat; and lime, alumina, and the alkalies are melted, and even volatilized in a few minutes. Rock crystal and quartz are converted into glass. Opal and flint into enamel. Blue sapphire, talc, emerald, lapis lazuli, are converted into glass. Gold and diamond are volatilized. Platina and brass wire burn with a green flame. Copper melts without burning; but iron burns with brilliant light. Iceland spar and strontian and pure lime give out an amethyst-coloured flame.

When oxygen and hydrogen are burned, the heat is 2578 deg.; but the same oxygen and charcoal give 2967 deg.; and with iron, zinc, and tin, 5825 deg. *Despretz.*

Mercury for thermometers is purified by agitation in a bottle with sand, and then by straining it through leather.

There are four thermometrical scales in general use, by which mercury determines heat from its freezing point, at 40 deg. below zero, to 600 deg. where it boils.

Fahrenheit begins at 32 deg. below the point of freezing water, for 0 or zero; and setting 32 at the freezing point, he ascends, to 212, the heat of boiling water; taking 98 as blood heat, and 176 as the heat at which alcohol boils; 55 as temperate, and 76 as summer heat.

Fahrenheit supposed, erroneously, that 32 of his divisions below the freezing point of water (0 on his scale) was the *zero*, or greatest degree of cold.

Reaumur's begins 10 degrees of Fahrenheit below Fahrenheit, and divides up to the freezing into 20 deg. Then above begins again; and his 20 corresponds with 77 deg. of Fahrenheit, and his 40 deg. with 122 of Fahrenheit, and his 80 deg. with 212 of Fahrenheit; every 2¼ of Reaumur being 1 of Fahrenheit, taken from the freezing point.

Celsius counts 25 below the freezing point; and above, his 10 corresponds with 50 of Fahrenheit, and his 50 with 122 of Fahrenheit.

De Lisle begins at the boiling point, and reckons downwards from 0 to 150, at the freezing point; his 177 corresponding with 0 in Fahrenheit, and with 17 of Celsius, and his 75 with 40 of Reaumur, 122 of Fahrenheit, and 50 of Celsius.

The Centigrade thermometer divides 32 to 212 of Fahrenheit into 100 deg., i. e. 180 as 100. Then 20 deg. to zero.

Fahrenheit and Reaumur are most frequently quoted. 10 of Reaumur below freezing is 9½ of Fahrenheit; 5 of R. above freezing 43½ of F.; 10 of R. 54½ of F.; 15 of R. 66 nearly of F.; 20 of R. is 77 of F.; 25 of R. is 88½ of F.; 30 of R. is 99½ of F.; and 35 of R. is 110¾ of F.

In Wedgewood's pyrometer he begins at red heat visible by daylight, or 1077 deg. of Fahrenheit; and every deg. with Wedgewood is 130 deg. of Fahrenheit. In his scale he found that brass melts at 21, silver 28, gold 32, and iron 160, being 21897 of Fahrenheit. It measures up to 32277.

CHYMISTRY.

The science of chymistry assumed its modern character in the hands of Beecher and Stahl, residents of Mentz. They first perceived the connexion of the atmosphere and of gases, with the production of phenomena, and paved the way for the discoveries of Bergman and Scheele, two Swedes, who died in 1784 and 1786, and were contemporary with Priestley in England, and Lavoisier in France; while Berzelius, another Swede, Fourcroy and Berthollet in France, and Thompson and Davy in

England, have conferred arithmetical precision on its pursuits.

One volume of any gas combines with one of another, or with two or three exactly.

The weight of an atom of oxygen is to one of hydrogen as 8 to 1, or 1 to 0.125; and to one of nitrogen or azote as 4 to 7, or 1 to 1.75.

Metallick oxydes are formed by one, two, or three equal doses of oxygen.

The specifick gravity of nitrous gas is the mean of the oxygen and azote.

100 measures of carbonick oxyde and 50 of oxygen, make 100 of carbonick acid.

100 measures of azote and 300 of hydrogen, make 200 of ammoniacal gas.

100 measures of oxygen gas, at 1.111, and 200 of hydrogen, at 0.69, form water.

100 cubick inches of hydrogen weigh 2.117 grains; and the same combined with sulphur make 100 of sulphureted hydrogen gas, weighing 35.89.

The weight of an atom of oxygen is taken as unity, as the relative standard of other atoms.

100 cubick inches of oxygen, combined with burning charcoal, are 100 of carbonick acid gas, weighing 46.313 grains, of which the carbon weighs 12.641, and the original oxygen 33.672.

An atom of copper weighs 8; of platinum 12.161; of tin 14.705; of gold 24.838; of lead 26; and of iron 7.143.

An atom of carbon is 0.751.

An atom of sulphur is 2, or twice that of oxygen.

The oxygen in the acid of a neutral salt is a multiple of the oxygen in the base by 2, 3, 4, &c.

The weight of an atom of manganese is 6.833.

An atom of iron 7.143.

An atom of copper 8.

An atom of antimony 11.249.

An atom of silver 13.714.

An atom of platinum 12.161.

An atom of gold 24.838.

An atom of lead 25.974.

An atom of sulphur 2.0434.

The weight of an atom of ammonia is 2.128; of magnesia 2.503; of lime 3.62; barytes 9.7; oxalick acid 4.625, and it is a compound of 3 atoms of oxygen, 2 of carbon, and one of hydrogen.

In forming nitrous gas, by mixing oxygen and nitrogen, no condensation takes place. The bulk is equal to the bulk of the two, and the specifick gravity is the mean of both.

When 100 measures of carbonick oxyde and 50 measures of oxygen gas are united, the compound is but 100 measures; and when 100 measures of azote are mixed with 300 measures of hydrogen, they form but 200 measures of ammoniacal gas.

Sulphurick acid is 1 of sulphur and 1 five-tenths of oxygen.

Carbonick acid is 1 of carbon and 2.666 of oxygen.

The weight of an atom of oxygen is considered as 8, and an atom of hydrogen as 1, and an atom of sulphur is 16. 100 cubick inches of hydrogen gas weigh 2.117 grains; and 100 cubick inches of sulphureted hydrogen gas, of equal bulk, weigh 35.89; being 2.117 of hydrogen 33.773 of sulphur, or 33.445 of sulphur.

The weight of an atom of chlorine is 4.498.

The weight of an atom of hydrogen is 0.132, but it is taken as one-eighth, or .0125. Oxygen being the common integer or 1.

7.5, or 11.25, or 15 of oxygen combine with all the metals, and form protoxydes or peroxydes.

33.5 or 67 of chlorine form chlorides.

50.5 or 101 of nitrick acid form nitrates.

37.5 or 75 of sulphurick acid form sulphates.

20.7 of carbonick acid form carbonates.

25 of phosphorick acid form the phosphates.

15 or 30 of sulphur form the sulphurets.

Oxygenated water is a compound,

by weight, of 1 hydrogen and 16 oxygen, or equal volumes.

100 cubick inches of carbonick acid weigh 46.5 grains, and 100 cubick inches of oxygen 33.8 grains; hence the carbon is 12.7 grains.

100 cubick inches of carbureted hydrogen weigh 29.6 grains, of which the carbon is 25.4.

A cubick inch of water, ther. 60 deg. weighs 252.52 grains, and contains 28.06 grains of hydrogen, and 224.46 grains of oxygen. The volume of 28.06 hydrogen is 1325 cubick inches, of 224.46 grains of oxygen is 662 cubick inches; consequently, the cubick inch is expanded in the gases 1987 times.

4 volumes of nitrogen, with one of oxygen, form atmospherick air in all situations, high and low, hot and cold.

Copper filings and sulphur unite in the proportions of 80 copper to 20 of sulphur, and also 64 of copper to 32 of sulphur.

The sulphurick acid has 100 parts of sulphur to 150 of oxygen; the sulphurous is equal. Phosphorick acid is 100 phosphorus to 115 oxygen; and phosphorus acid is 100 to 58. Carbonick acid is 100 to 25; and boracick acid is 100 to 200. Nitrick acid, the base of which is nitrogen, is 29.77 nitrogen to 70.23 oxygen; and arsenick acid is 65 arsenick and 35 oxygen.

79 parts of nitrogen and 21 of oxygen make vital atmospherick air; 79 and 42 make nitrous oxyde, an intoxicating gas; 79 and 84 make nitrick oxyde gas; 79 and 168 make nitrous acid, fluid; 79 and 210 of oxygen make nitrick acid.

Modern theory considers the nonmetallick elements as, oxygen, whose *equivalent* is 8, chlorine 36, bromine 75, and iodine 124, as *electro-negative;* and hydrogen 1, nitrogen 14, sulphur 16, phosphorus 12, selenium 40, carbon 6, silicon 8, and boron 6, as *electro-positive.*

Their acid binary compounds are *electro-negative*, and the rest *neutral*, except ammonia (15) which alone is alkaline, basick, or *electro-positive.* Then the unions with *satifiable bases* of some of the twenty-two acids are *salts.*

Of the twenty-two neutral compounds—1 hydrogen (1) 1 oxygen (8) form water (9); 1 carbon (6) + 1 oxygen (8) form carbonick oxyde (14); 2 carbon (12) + 1 nitrogen (14) form cyanogen (26); 1 silicon (8) + 1 oxygen (8) form silex (16); 2 carbon (12) + 2 hydrogen (2) form carbureted hydrogen (14), the most important.

The equivalents of the metals are, antimony 44, arsenick 38, bismuth 71, copper 64, cadmium 56, chromium 28, columbian 144, gold 200, iron 28, lead 104, mercury 200, molybdenum 48, manganese 28, nickel 30, platinum 96, palladium 56, rhodium 44, silver 110, tellurium 29, tungsten 96, tin 59, zinc 34.

The natural metals afford nine acids, all from 2 arsenick, 2 molybdenum, 2 antimony, 1 columbian, 1 tungsten, and 1 chromium. 22 alkaline binary compounds, and 26 neutral. Their compounds being reduced at the negative or alkaline side of the voltaick battery, they are called *electro-negative.*

Chymical compositions always take place in definite proportions, which are determined by experiment; and as arithmetical seem to be mechanical, or subject to the laws of motion, arising from the forms of the atoms, or the combinations which facilitate or obstruct their motions when active, as in fluids or gases. What has been called elective attraction, affinity, and repulsion, are exemplifications of these laws of motion in different atoms.

All compound bodies, or the smallest portions of them, are composed of the same constituents, united in fixed proportions. This discovery was made by Higgins, Bergman, Kirwan, and Wenzell; and perfected by Richter, Berthollet, and Dalton. Gay Lussac showed that one volume of any gas always combines with one, two, or three of another gas: thus, one volume of ammonia with one volume of muriatick acid, produces neutral muriate of ammonia; or with one volume of carbonick acid, produces carbonate of ammonia.

Compounded bodies whose elements are gaseous, consist either of equal volumes of those elements, or if one

excced the other, the excess is by some regular multiple of the volume.

The proportions in which oxygen combine are designated by the prefixes *prot*, for one degree, as *prot-oxyde;* for the second, *deut*-oxyde; for the third and upwards *per*-oxyde. The syllable *bi* is prefixed in other cases to signify a double proportion of either compound, as *bi* sulphuret of potash.

Eight parts by weight of oxygen and one of hydrogen, form water; hence the equivalent numbers of the three are 1, 8, 9. If oxygen be taken as 10, then hydrogen is 1.25, and water 11.25. These are the standards for the equivalents of all bodies. Water is also formed of one volume of oxygen to two of hydrogen. When water is decomposed by electricity, the hydrogen at the negative pole is double the volume of the oxygen at the positive pole.

The division of all substances into electro-negative and electro-positive, arises from the position they take when placed between the poles of a voltaick battery. Those which go to the *negative* pole are called *electro-positive*, and those to the *positive* pole *electro-negative*. Oxygen and chlorine are electro-negative, and hydrogen and nitrogen are electro-positive.

The solution of fixed bodies by fluids, arises from the atomick motions of the fluid, and as these are increased by heat, or more motion, the solution is more rapid. A lump of dry alum is thus dissolved in half the time in water at 80 deg., and in a fifth at 120 deg. Fluids of the same degree of motion mingle at once, others in longer time; and some give out, and some absorb heat in mixing. Some theorists ascribe these variations to attractions and repulsions; peculiar, if possible, powers which the phenomena do not demand. Motion is, of course, opposed to cohesion, and its withdrawal favourable to fixity. This is the repulsion and attraction of modern theorists.

The solution of solids always absorbs heat, or motion, and their resolidification gives it out. Fluids have also to dissolve one another, and hence produce heat or cold, as the resulting volume is less or more. Some atoms become fluid or gaseous sooner or later than others, and some fluids and gases have more or less motion in the atoms which compose them, and these circumstances create most of the phenomena of chymistry. Others, however, ascribe them to attraction and repulsion, while it is alleged by others that attraction and repulsion are impossible.

The oxydes of mercury, silver, gold, platinum, rhodium, iridium, osmium, nickel, paladium, and their binary compounds are reduced by heat alone, and are called electro-positive.

Lead, cobalt, copper, bismuth, arsenick, antimony, and eight others, retain and absorb oxygen at high temperatures.

Tin, iron, zinc, cadmium, manganese, and their binary compounds retain oxygen and decompose water at high temperatures.

Potassium, sodium, and other alkaline metals decompose water at the common temperature, and absorb oxygen at all temperatures. They are called metals, but it may be doubted whether they are other than *supersaturated* inflammables, such being the process by which they are artificially formed, either by galvanism, or other combination.

There are also five artificial metals derived from earths, but these and the six alkaline substances belong as metals rather to theory than to nature. The natural metals are twenty-eight in number.

Silica is the basis of the mineral world, and carbon of the organized.

Pure silex or silicon is a dark brown solid without lustre, and infusible.

Silex is acidulous and electro-negative in its affinities. By its insinuating powers it renders bodies acidulous or electro-negative in various degrees, down to potass, the highest electrick positive or alkaline substance. These terms electro-positive, and electro-negative, being equivalent to the acid and alkaline of the last generation of chymists. Electricity itself being nothing more

than a mechanical separation of the same pure and abstract elements.

Charcoal is made by burning piles of wood, and stopping out the air, in the manner of brick-kilns, or by exposing wood in sand in a crucible to a strong heat.

Charcoal destroys the taste, colour and smell of many substances. Vinegar boiled with it becomes limpid, and it destroys the colour and flavour of rum and other liquors; it also restores putrid water and tainted meat. Charcoal fires are dangerous in close apartments, for the oxygen is combined or fixed by it.

If charcoal from any wood is heated, it becomes a common elementary substance called CARBON, which absorbs moisture, air, and oxygen and hydrogen gases. If heated to 800 degrees in oxygen gas, the combination of the two is called carbonick acid gas, or fixed air, the specifick gravity of which is 1.518. It also unites with hydrogen called carbureted hydrogen, and its specifick gravity is 0.555, the weight of 100 cubick inches being seventeen grains, and this is the gas which is prepared at the gas works for purposes of illumination. Its combustion absorbs twice its weight of oxygen.

Sulphur, a volcanick product, has not been decomposed, and is therefore assumed to be a simple elementary substance. Its specifick gravity is 1.99. If heated a little above boiling water it becomes a brown transparent oil, and if burnt and the vapour condensed, it is sulphurick acid or a compound of sulphur and oxygen, in the proportion of one part sulphur to one and a-half oxygen; and when the proportions are equal it is called sulphurous acid; when sulphur is combined with hydrogen, it forms sulphureted hydrogen gas of the density of oxygen. As sulphur burns, i. e. fixes oxygen, it evidently contains hydrogen.

Sulphur burns with a pale blue light at 185 degrees; but it fixes so little oxygen, that is, creates so little heat that it may be burned at that heat in the gunpowder of which it is a part. Its vapours whiten silk and straw. Hydro-sulphurick acid is obtained by burning eight parts of sulphur and one of nitre in close vessels containing water, which absorbs the fumes. Evaporation yields oil of vitriol, which decomposes animal and vegetable substances, owing to its affinity for the water which they contain, and converts them into charcoal. Its concentrated state at a specifick gravity of 1.85 contains 81 per cent. of acid.

Acids and alkalies are to each other like negative and positive, and when mixed in equal preportions neutralize each other, and when neutralized, are in equal proportions.

Acids change blue, purple, and green colours of vegetables into red; and neutralize alkalies and earth. The elementary principle is oxygen. There are eighteen mineral acids, nine vegetable, and five animal.

Salts are compounds of acids with alkalies, earths and metallick oxydes: when the acid contains one degree of oxygen it terminates with *ite*, and when with higher degrees with *ate*. These are the generick names, and the name of the base of the salt is also added as muri*ate* of ammonia or phosph*ate* of lime from muriatick acid and ammonia, and from phosphorick acid and lime: thus there are muriates from muriatick acid, fluates from fluorick acid, borates from boracick acid, and phosphates from phosphorick acid, sulphates from sulphurick acid, carbonates from carbonick acid, nitrates from nitrick acid, oxymurates from oxymuriatick acid, arceniates from arsenick acid, oxalates from oxalick acid, tartrates from tartarick acid, prussiates from prussick acid, &c. besides phosphites, sulphites, and nitrites for lower degrees of acidity.

Iodine is a simple substance, of the specifick gravity of nearly five; its odour is like chlorine, and it is very active. It is of a violet colour, easily evaporates, and melts at 220 degrees; changes vegetable blues to yellow, and a seven-thousandth part converts water to a deep yellow colour, and starch into a purple. Five volumes of oxygen and one of iodine form iodick acid. It is made from *kelp*, of a dark gray colour and metallick lustre, and in its gaseous state is purple.

Magnesia is made from Epsom salts, by putting potash into a solu-

tion of it in water; the precipitation is magnesia.

Fluorick acid is a product of Derbyshire spar and sulphurick acid. Its specifick gravity is 1.06, and is very corrosive. It etches and corrodes glass.

The basis of phosphorus is calcined bones, digested with sulphurick acid, &c. &c.

Alkalies have the power of changing the blue vegetable juices to green, the green to yellow, the yellow to orange, the orange to red, and the red to purple. Acids change vegetable blues to red. Chlorine destroys all colours.

Alkalies consist of ammonia, potash, soda, and lithia. The alkaline earths are lime, magnesia, barytes, and strontian. The neutral earths are silica, allumina, ytria, glucina, and zireonia.

100 of pure potash are equal to 70 of concentrated sulphurick acid, and thus they are mutual tests.

Nitre or salpetre consists of six parts of oxygen, one of nitrogen, and one of potash. It is chiefly brought from the east, but it may be obtained by mixing the rubbish of old buildings with animal and vegetable matter, exposing them to the air in a dry place for some months. It is always a product of animal matter and of calcareous soil, and constitutes 75 of 100 parts of common gunpowder, the other 25 parts being half charcoal, and half sulphur.

Ammonia is a compound of hydrogen and nitrogen, and usually called volatile alkali Davy, after galvanizing soda and potash, made an experiment to prove that there was oxygen in ammonia.

Davy, by compounding the galvanick elements with these alkaline earths, made substances which he called metals, as calcium, from lime, magnium, barium, and strontium. These from their earthy base proved heavier than the alkaline metals.

Allumina is the chief constituent of clay; it combines with lime, and hence the use of lime in iron stone.

Lime is obtained by burning parts of rocks and mountains which are often composed of it. When burnt, it is corrosive, and tinges blue vegetable infusions green; it is slacked by pouring water upon it, which becoming fixed and solid, gives out the excitement or heat which rendered it fluid. This is the cause of the heat which accompanies the slacking of lime; one-fourth in weight being water. Limestone, in its native state, is united with carbonick acid, which the burning drives off. Water then swells it and reduces it to powder, in which state it is converted into mortar, after which it combines with carbonick acid, and hardens again. Limestone by calcination, parts with 44 per cent. of its weight in carbonick acid gas. In slacking, it doubles in bulk, and imbibes the hydrogen of the water as mortar; and consists of 31 parts water and 100 lime.

Thenard enumerates 28 gases at the freezing point of water. Chlorine and its compounds are green, and nitrous vapour red. Hydrochlorick, fluoborick, fluosiliseck, and hydriodick produce white vapours. Inflammable gases, are hydrogen and its sulphurets, arsenurets, tellurets, selenurets, and potassurets; also hydrurets of phosphorus and of carbon, carbonick oxyde, cyanogen. Supporters of flame, are oxygen, oxyde of azote, and chlorine. Acid gases which redden litmus are sulphurous, fluoborick, fluosiliciek, hydriodick, hydrochlorick, carbonick, and chloro-carbonick. Sulphurets and tellurets of hydrogen, and cyanogen, oxyde of chlorine, destroy the red which they first produce. Oxygen, azote-hydrogen, hydruret of carbon, carboniek acid, and oxyde of azote, have little odour, compared with others. Those soluble in one thirtieth of water are fluoborick, fluosiliciek, hydrochlorick, hydriodick, sulphurous acid, and ammonia. The acid gases, sulphurets, and tellurets of hydrogen, chlorine, cyanogen, and ammonia are soluble in alkaline mixtures; and alkaline gas in ammonia.

The term gas, is German for ghost, and was first applied by Van Helmont and Mayow, who discovered their existence, but did not analyze them. All of them owe their existence to their own intestine motion, and if this is artificially or mechanically destroyed, they return to a fluid or solid state.

Galileo discovered the weight of the atmosphere; Boyle its elastick character and connexion with sound. Priestley, Scheele, and Mayow, in 1774, investigated its chymical relation. Its weight is to water as 1 to 828, and 100 cubick inches weigh 30.5 grains, the bar. 30, and ther. 60.

A bulk of 1000 at 32 degrees, becomes 1152 at 100 degrees, 1376 at 212 degrees, and 2797 at 1000 degrees. It consists of 79 azote or nitrogen, and 21 of oxygen or vital air in bulk. And their specifick gravities being 1.093 and .978, so 100 parts in weight are 77.44 of azote, and 22.57 of oxygen.

Chymists have been much divided about the proportions of oxygen and nitrogen in atmospherick air. Some make it 21 to 79. Some 22 to 78; and others, 22.9 and 77.1.

Air, with the barometer at 30 inches, and the thermometer at 55, is 833 times heavier than water, and a cubick foot of it weighs 1.2 ounces avoirdupois; the weight of a cubick foot of water being 1000 ounces; and a cubick foot of quicksilver 13600. Air will expand above 13000 times; air expands from .00209 at 1 deg., to 1 at 32 deg., 1.0476 at 54 deg., and 1.378 or 1.4 at 180 deg.; and all the gases expand in like proportion, or a 480th for every degree.

The pressure of the air keeps the gas among the atoms of fluids; and when removed, the gas escapes, and the atoms crystallize, as in freezing water under an air-pump.

A middle sized man consumes 46000 cubick inches, or 26 cubick feet, or nearly a cubick yard of oxygen per day, making 20 respirations in a minute, and 1.6 cubick inch at each.

The weight of the atmosphere compresses water about the 22000th of its bulk: spirits of wine the 15000th part; and mercury the 33000th part. The pressure of water at the depth of 500 fathoms, diminishes the bulk of the water a 27th.

Air contains about a 1200th part of carbonick acid gas, and a 70th of aqueous vapour. The causes of marshy and pestilential vapours have not been determined, but they yield to re-agents, as nitrick acid and oxymuriatick fumes.

The weight and elastick force of air raise water, in an exhausted tube, 33 to 35 feet, and quicksilver from 28 to 31 inches, a force equal to 15 lbs. to the square inch, or 20560 lbs. to the square foot. The weight of the whole atmosphere is thus, 12 quadrillion pounds.

A cubick foot of air weighs $1\frac{1}{5}$ oz., hence, a column a mile high, and one inch base, weighs 43.2 ounces, and 15 lbs. are equal to $5\frac{1}{4}$ miles. It diminishes in weight as the distance, and in elastick force or reaction as the bulk or cube of the distance, together as the fourth power; but in density as the logarithm of the height; hence, at 44 miles, where it ceases to reflect the atmosphere, its density is considered but a 10000th of that at the surface.

Taking platina as 19.5 of water, and air as .0012, a cubick inch of platina is equal to 16350 cubick inches of air, and to 221000 of hydrogen as .0735 of air. Consequently, if platina were volatilized into hydrogen, and its atoms were as platina, the 10 millionth of an inch asunder, the same atoms as hydrogen would be but the 50th of an inch asunder. Water as steam at 285 degrees is 72000 times its own bulk, i. e. 3 million times rarer than platina; and *cæteris paribus*, its atoms nearly the third of an inch asunder.

Air, of the density of that near the earth, would be opaque in a thickness of seventeen miles.

Atmospherick air at a heat of 1035 degrees, expands $2\frac{1}{2}$ times.

Air at the freezing point increases 100th part in bulk at 37 degrees, a 50th part at 42 degrees, a 20th at 60 degrees, a 7th at 100 degrees, a 3d at 190 degrees, and 0.37 at 212 degrees.

Fluids consist of minute atoms separated by gases, and the motion of heat creates this one degree of gasification, while another degree converts the whole into gas.

100 cubick inches of atmospherick air weigh 30.5 grains, of oxygen 33.8, hydrogen 2.1, nitrogen 29.7, chlorine 76.3.

The aqueous vapour in atmospherick air seems essential to animal and vegetable life; the dried winds of Africa called Harmattan being

very destructive. At 65 deg. one sixtieth is vapour, and at 90 deg. a cubick foot contains 12 grains of water. Hydrogen contains a 7th of its weight, oxygen the 110th, and carbonick acid the 140th.

100 cubick inches of air at 57 deg. contain 0.35 of a grain of moisture.

Under a receiver thoroughly exhausted, rare and dense bodies fall with equal swiftness. Most animals die in a minute or two, but some amphibia live hours. Vegetation stops, combustion ceases, gunpowder will not explode, magnets are equally powerful, smoke descends, water and other fluids turn to vapour, glowworms give no light, a bell sounds very faintly, heat is slightly transmitted.

Wilkins and Lana first suggested the idea of ascending in the atmosphere by rarefied air, and one Galien of Avignon, in 1755 wrote a pamphlet on ærostation.

The first balloon of Stephen and Joseph Montgolfier, was a silk bag containing forty feet, which burning paper raised seventy feet. Their next was a bag of 650 feet, which rose 600 feet. Their third was 35 feet in diameter, and was capable of raising 500 pounds. It was raised before the publick, June 5, 1783. On the 21st of November, Pilatre de Rosier and the Marquis d'Arlandes ascended at Paris, and afterwards others, with air rarefied in the car by heat.

In December 1783, Messrs. Roberts and Charles ascended in a balloon inflated with inflammable gas, and after them Blanchard, Morveau, the Duc d'Orleans, and others. In September 1784, Lunardi made the first human ascent in England.

In January 1785, Blanchard and Jeffries passed from Dover to Calais, and soon after Rozier and Romaine perished in an attempted voyage from Bologne to England. In September 1802, Garnarin descended from a parachute near London.

On the 6th of September, 1804, Gay Lussac ascended at Paris to the height of 23000 feet.

The superficies of a balloon is computed by multiplying the square of its diameter by 3.146, or the cubick contents is the cube by .5236. Taking atmospherick air at 1.2 oz. to the cubick foot, we have the weight in air, and then, as carbureted hydrogen gas weighs 0.2, the weight multiplied by 0.2 gives the power of ascension, deducting the weight of the car, ropes, silk, &c.

Oxygen, the supporter of vitality and fire, was first discriminated as a distinct gas by Priestley, in 1774. Its existence was known to Scheele as empyrial air; but as the apparent antagonist of combustible gas or Stahl's phlogiston, he called it dephlogisticated air. 21 parts of it are in 100 parts of atmospherick air, and it is one eighth or one ninth heavier. 100 cubick inches of the latter weigh 30½ grains troy, and the same measure of oxygen weighs from 33 to 34 grains. Oxygen is obtained by simply heating black oxyde of manganesc.

Acids change vegetable blues to red, and in combination with other bodies form salts. Their general principle is oxygen in combination. One proportion of oxygen has a termination *ous;* and a further proportion has a termination *ic.*

When oxygen is combined with any substance, and not acid, it is called an oxyde; and when rendered acid, the combination is called an acid. Water is a combination, 7 of oxygen with 1 of hydrogen, therefore called an oxyde of hydrogen. It may be decomposed by charcoal at a red heat; as in slacking lime, it sometimes combines with the solid, which is then called a hydrate. It boils at 212 deg. and generates elastick steam 1800 times its own bulk. A cubick foot is taken at 1000 oz., but is ten elevenths of an ounce less. A cubick inch weighs, at 40 degrees, 252.953; and at 60 deg. by expansion, is but 252.72 grains.

When carbonick acid gas is liquefied, its elastick force at 12 deg. is equal to 20 atmospheres, and at 32 deg. to 36.

Carbonick acid gas is a compound of 72 of oxygen and 28 of charcoal. It forms one-thousandth part of the atmospherick air, and is chiefly generated by combustion and the respiration of animals. Its specifick gravity is 1.518.

Carbonick acid gas is a product of fermentation, and being heavier than air it lies over all fermentive pro-

cesses, puts out a candle, and produces suffocation. At the bottom of wells and coal mines it causes the choke-damp, in which a light will not burn, but which may be dispersed by throwing water into it. It is carbureted hydrogen which takes fire in coal mines, and which, under the name of fire-damp, destroys so many miners.

Hydrogen, the phlogiston of Scheele and Priestley, is that gas which, when excited, immediately combines with oxygen and produces flame, by which the oxygen disappears, and a new concentrated substance is produced. From this connexion with flame Cavendish called it inflammable air, but it is now called hydrogen, because in bulk it is the chief constituent of water. It is contained in all bodies which burn with flame, and is separately produced by pouring dilute sulphurick acid upon iron filings. It is thirteen times lighter than common air; for 100 cubick inches of it weigh but 2.5 grains. Water is a compound of oxygen and hydrogen, in the proportion of 7.5 grains of oxygen to 1 of hydrogen.

Sulphureted hydrogen is poisonous, and the 250th part of it in the atmosphere has killed a horse. It tarnishes metals; it gives the flavour of rotten eggs to water, like that of Harrowgate.

Priestley discovered nitrogen to be the other component of the atmosphere. It is also called azote. It is the gas that remains after atmospherick air has been deprived of its oxygen; and it is found to be nearly four-fifths of the volume, or as 79 to 21. This separation may be effected by putting sulphur and iron filings into a close vessel; and they absorb the oxygen and leave the nitrogen. Its specifick gravity is .097, or rather lighter than common air. It appears in the atmosphere to dilute the oxygen or vital gas, for by itself it destroys flame and animal life.

Chlorine is an artificial gas: it is made by mixing three parts of sea salt with one of black oxyde (peroxyde) of manganese, and pouring on them four parts of sulphurick acid and water, in equal proportions. Then, by heat, the gas is evolved, of a yellowish-green colour, and offensive smell. 100 cubick inches of this gas weigh 76.3 grains.

1 chlorine (36) + 1 of hydrogen (1) form muriatick acid gas (37); 100 cubick inches of this gas, are formed of 50 cubick inches, or 38.1 grains of chlorine, and 50 cubick inches, or 1.05 grains of hydrogen, and, therefore, weighing 39.15 grains.

1 chl. (36) + 1 ox. (8) make protoxyde of chlorine (44); and 4 of ox. make peroxyde (68); or 8 of ox. perchloriek acid (100.) The chloride of nitrogen (158) is 4 chl. + 1 nit., and an oily fluid, very explosive and combustible.

As the chlorine gas supports combustion, it has been considered as a combination with another substance, which increases its density to 2.713. that of air being 1.000, and that of oxygen being 1.120. Some chymists maintain that it is an original simple substance.

The five heaviest gases are—

Chlorick gas	2.47
Nitrick acid gas	2.427
Sulphurous acid gas	2.097
Vapour of ether	2.25
Vapour of alcohol	2.1

The four lightest gases are—

Carbureted hydrogen	0.555
Arsenical hydrogen	0.529
Phosphureted hydrogen	0.352
Hydrogen	0.074

1 carbureted hydrogen explodes with 5 oxygen.

Gases mix equally, and when mixed do not separate. Dalton ascribes this to the particles being of different sizes.

Water, by weight, is 1 of hydrogen and 7½ of oxygen; and by bulk 2 of hydrogen and 1 of oxygen.

Sulphurick ether consists of—

Carbon	58.2
Hydrogen	22.14
Oxygen	19.66

Alcohol consists of—

Oxygen	37.85
Carbonate	43.65
Hydrogen	14.94
Azote	3.52
Ashes	0.04

Nitrick ether consists of—

Oxygen	48.52
Carbon	28.45
Azote	14.49
Hydrogen	8.54

Muriatick ether consists of—

Muriatick acid	29.44
Carbon	35.61
Oxygen	23.31
Hydrogen	10.64

Acetick acid, or distilled vinegar, is composed of—

Oxygen	44.147
Hydrogen	5.629
Carbon	50.224

Oxalick acid is composed of—

Oxygen	70.689
Hydrogen	2.745
Carbon	26.566

Tartarick acid consists of—

Oxygen	69.321
Hydrogen	6.629
Carbon	24.05

Citrick acid, prepared from the juice of lemons, consists of—

Oxygen	59.859
Hydrogen	6.33
Carbon	33.811

The substance of brain consists of the following constituents:—

Water	80.
White fatty matter	4.53
Red ditto	0.7
Albumen	7.
Osmazome	1.12
Phosphorus	1.5
Salts and Sulphur	5.15

Wax consists of—

Carbon	81.784
Hydrogen	12.672
Oxygen	5.544

Rosin consists of—

Carbon	76
Oxygen	13
Hydrogen	11

Copal consists of carbon 77, oxygen 11, and hydrogen 12.

Oak wood contains 42 oxygen, 52 carbon, and six hydrogen.

Beech contains 43 oxygen, 51 carbon, and six hydrogen.

Wheat and barley contain as under:

	wheat	barley
Silica	13.2	66.7
Carbonate of lime	12.6	24.8
Carbonate of magnesia	13.4	25.3
Allumina	.6	4.2
Oxyde of manganese	5.	6.7
Oxyde of iron	2.5	3.8

The quantity of each being 2 lbs.

Oats contain silica 144.2, and rye straw 152 silica.

One-twelfth of wheat is gluten, which consists of oxygen, hydrogen, azote, and carbon.

Autumnal wheat contains 77 starch and 19 gluten; spring wheat, 70 starch, 24 gluten.

Starch contains from 38½ to 45 of carbon, from 6 to 7 of hydrogen, and from 48½ to 55 of oxygen.

168 potato starch consist of oxygen 49.455; carbon 43.481; and hydrogen 7.064.

Mucilage from 36 to 45 of carbon, from 5½ to 7 of hydrogen, and from 48 to 55 of oxygen.

Sugar from 37½ to 43⅓ of carbon, from 6⅓ to 7 of hydrogen, and 50⅓ to 55⅔ of oxygen, according to the analyses of five or six different chymists.

Fermented sugar and water consists of 57 parts alchohol and 43 carbonick acid.

Sugar itself, per Berzelius, is 7 hydrogen, 44 carbon, and 49 oxygen.

Alcohol, 14 hydrogen, 52 carbon, and 34 oxygen.

Carbonick acid, carbon 27, oxygen 73.

The real quantity of alkali contained in the substances used in bleaching, of 100 parts is

American pearlashes	60 to 73
Russian pearlashes	52 to 58
White Dantzic do	45 to 52
Alicant barilla	20 to 33
Natron	20 to 30
Salt of tartar	72
Common Salt	53

Barley contains 43 parts of volatile matter, 72 of husk, and 269 of meal, of which last 20 are saccharine matter. A bushel weighs 50 lbs. and a grain is the third of an inch.

Ammonia is called volatile alkali; and potash and soda fixed alkalies. Ammonia is a compound of

81.5 azote
18.5 hydrogen

by weight; and in bulk three parts of hydrogen for one of azote. Ammoniacal gas passed through burning charcoal becomes *Prussick acid.* When combined with oxydes of gold or silver it renders them fulminating. Potash, or fixed vegetable alkali, is procured from the ashes of vegetables exposed to the air; it runs into liquid, and is very acrid and corrosive. Its specifick gravity is 1.7.

Soda is a mineral alkali, but may be procured like potash from ashes. Its specifick gravity is 1.34.

Albumen is an animal substance, of which the white of an egg is an example. It becomes a white coagulate at 165 deg., and if acids are united to it. It contains 53 carbon, 24 oxygen, 7 hydrogen, and 16 nitrogen.

Animal substances, besides the principles of vegetables, yield ammonia, sulphur, and phosphorus, and their compounds with carbon.

Oil and fat are compounds of carbon, hydrogen, and oxygen. Fat consists of two substances, one which melts at 50 deg. and the other at 105 deg.; the former oil and the latter suet. Butter made in summer contains 60 of oil and 40 of suet; but in winter 37 of oil and 63 of suet. Goose grease contains 68 of oil and 32 of suet. Olive oil contains 72 of oil and 28 of suet.

The perspiration from an animal body consists of water, carbonick, acetick, and phosphorick acids and soda.

The curd of cheese consists of 60 carbon, 11 oxygen, 7 hydrogen, and 22 nitrogen.

Olive oil contains 76 parts of carbon, 12 of oxygen and hydrogen, and 9 of hydrogen in excess.

Olive or table oil contains

Carbon	77.213
Oxygen	9.427
Hydrogen	13.36

Naptha is a bituminous oil, clear as water, and very volatile. Its specifick gravity is 0.8. Petrolium is darker than naptha, and obtained by distilling coals.

Tar, pitch, asphaltum, and pitcoal, are natural bitumens.

Precipitate of mercury consists of 100 parts mercury, and 8 of oxygen.

Sulphuret of mercury consists of 200 mercury and 16 sulphur.

Vermilion is 400 mercury and 32 sulphur.

Calomel is 200 mercury and 36 chlorine.

Corrosive sublimate is 200 mercury and 72 chlorine.

Sugar of lead is 112 lead and 50 acetick acid.

White vitriol is 40 parts sulphurick acid and 41 zinc.

Urinary calculi contains six acidulous combinations besides magnesia; silica and urea, uriek acid, phosphate of lime and magnesia, and oxalate of iron are the principal.

Alcohol is the spirit of wine obtained from the distillation of fermented liquors, and from wine is called brandy; from the sugar-cane, rum; from malt or grain, whiskey and gin. The different flavours arise from the quantity of oil or resin, the bases being alcohol and water. Further distillation produces rectified spirits, the specifick gravity of which is about .85; but by further rectification it may be carried to 0.795. Pure alcohol is quite colourless and transparent; it never freezes, but evaporates spontaneously, boiling at 173½ deg. Proof spirits are 0.92. When the gravity is higher they are under proof, when lower above proof. Perfectly pure alcohol is about 0.74. The flame is blue, and it leaves no residuum. The vapours consist of carbonick acid and water, and the bulk of water is greater than the alcohol.

Professor Brande's analysis of the quantity per cent. of alcohol, or pure spirit, in the following liquors:—

Scotch whiskey	54.32
Irish	53.9
Rum	53.68
Brandy	53.39
Gin	51.6
Port	22.9
Madeira	22.27
Currant	20.55
Teneriffe	19.79
Sherry	19.17
Claret	15.1
Champagne	13.8
Gooseberry	11.84
Elder	8.79
Ale	6.87
Porter	4.2
Cider	9.8 to 5.2

Rochelle salts consist of 54 tartrate of potash, and 45 tartrate of soda.

Sea water contains 1.35 of muriate of soda, .004 of muriate of magnesia, .0025 of Epsom salts, and .00125 of gypsum. It obstructs all light at 120 fathoms.

Urine contains no less than twelve

acidulous combinations, besides sulphur, resin, urea, albumen, and water when healthy; but in disease, other substances.

Thirty-eight several substances have been found in various mineral waters. The acidulous abound in carbonick acid. The chalybeate in iron. The hepatick in sulphureted hydrogen. The saline in salts.

Bristol or Clifton hot wells water is 74½ deg., and its specifick gravity 1.00077. A gallon contains 43¾ grains of sulphate of soda, sulphate of lime, and carbonate of lime, and four grains of muriate of soda. Also, 30 cubick inches of carbonick acid gas.

Buxton water is 82 deg.; and a gallon contains 11½ grains of calcareous earth, 2⅓ of vitriolick selenite, 2 of sea salt and azotick gas.

The waters of Aix-la-Chapelle contain 4.75 carbonate of lime, 5 muriate of soda, and 12 carbonate of soda. The gas is sulphureted hydrogen.

Alphabetical arrangement of some substances, &c.

Acids change purples and blues to red.

Alkalies change blue vegetable colours to green, and brown to yellow. There are three, potass, soda, and ammonia. They unite with acids and form neutral salts, and with oils form soap.

Prussick *acid* is a deadly poison obtained from Prussian blue. It is colourless, but smells like peach flowers, and freezes at 2 degrees, and very volatile. It turns vegetable blues into red.

Alabaster is the old name for certain kinds of gypsum, and that of Volterra is semi-transparent.

Allumina is often called argil.

Alum or sulphate of iron, is a salt used as a mordant in tanning, to harden tallow, and in whitening bread. It may be made of pure clay, exposed to vapours of sulphurick acid, and sulphate of potash added to the lie. But it is usually obtained by means of ore called alum slate.

Amalgam is quicksilver combined with metal, generally tin.

Some suppose *ambergris* to be ancient bees' wax extricated from strata by the ocean.

The best *anemometers* are those of Dr. Lind and Dr. Brewster.

The fluids of *animal* bodies in their chymical properties, are watery, albuminous, mucous, oleaginous, resinous, saline, gelatinous, and fibrinous. Of these the solids are continued secretions in laminæ, and fibres or filaments, or tissues.

Aquafortis is nitrick acid with sulphurick and muriatick.

Aqua regia is two of nitrick and one of muriatick.

Argol or archel is a colouring substance obtained from *lichens*, used by dyers to improve other colours. It is brought from Elba and the Levant.

Arnatto is a dying substance, prepared from reeds which grow in the West Indies and Cayenne.

Arrack is made from the juice of the tops of cocoa nut and palmyra trees. At Batavia it is made from *paddee*, rice in the husk.

The *air pump* effects a rarefaction from a 500th to a 2000th, and seldom much higher.

Sulphuret of *antimony* is used in pharmacy and called *antimony*, while the metal is called the regulus.

Artificial teeth are made of the tooth of the sea horse, harder than ivory.

Balloons are filled with carbureted hydrogen gas, and by the Gas Companies, for about 5*l.*

Balm of Gilead, or Balsam of Mecca, is made from the resin which exudes from incision in the bark of a plant belonging to the genus amyris which grows near Mecca and in Abyssinia; its virtues are frequently extolled in the Jewish scriptures. The balsams of Tolu and Peru are made from resins which exude from South American plants. In the East its applications are various.

Nitrate of lime is *Baldwin's* phosphorus.

Bell metal is three of copper and one of tin.

Blende is a native sulphuret of zinc.

The *bitter* principle prevails in quassia, gentian, hops, chamomile, and some others; it has been made artificially by different chymists.

Bone in its solid parts is phosphate of lime organized by membranes, arteries, veins, lymphaticks, and nerves, and in a state of constant change, like the rest of the body. Madder in food stains bones, and abstinence restores them, and the vessels so palpably convey the matter of bone, that in cases of necrosis or death of a bone, a new bone is formed as a case to the dead one, which may be taken away when the case becomes a perfect bone in all its functions.

The *brain* and heart are the chief instruments of the lungs and are alike insensible. The cerebrum may be pressed or cut without pain, and in the time of Harvey, a young man had his heart exposed by a disease, and Harvey handled it without his fingers being felt.

The lymph and serum is common to all *Blood;* but in insects it is transparent; in caterpillars green; in frogs yellow; in fish it is red in the vital organs and transparent at the extremities; in man the red particles are too large for some of the vessels, as the coats of the eye, the tendons, and serous membranes. It is deepest red in quadrupeds and less so in birds, while it varies in some, being deeper in the hare than the rabbit. In animals with a double circulation, the venous blood is a dark Modena red, but the arterial is a light scarlet, and is the fluid on which depends excitement and sustenance. Venous is to water as 1049 to 1000, and arterial as 1052. Disease makes it lighter, but in full health it rises to 1126, and Haller only, says to 1527. In man, its temperature is 98 degrees, in sheep 102, and in ducks 107, and the arterial is higher than the venous. In ague it falls from 98 to 94, and in fever rises to 102 or 105. In man the red particles are the 5000th part of an inch. In birds larger, more so in reptiles, and larger still in fish, and largest in the skate. The arteries contain more than the veins, and the quantity increases with the temperature. The solid part after coagulation is the crassamentum or clot, and consists of the lymph or fibrin and the red particles, of which the first is the most important part of the blood constituting the solid parts of the body and the basis of the muscles. On separation, it floats in a fluid called serum or albumen like the white of an egg. Hunter ascribes life to the blood, that is, that the blood itself is alive! The blood is a fifth of the weight of the body, and three-fourths are in the veins.

Zinc, charcoal, and copper form *Brass* in the proportion of a third or fourth of zinc.

Bronze is two parts brass and one copper, and the Greeks added one-fifteenth of lead and silver.

Bronzing is a wash by composition made by grinding gold leaf with honey which is washed from the gold with water; or it is made by combining sixteen parts of tin, eight of mercury, eight of sal ammoniack, and seven of flour of sulphur. Red lead gives it a copper shade. There are other preparations for bronzing different substances.

Bromine is obtained from sea water and the ashes of sea weeds. It is red, poisonous, and very volatile.

Brown's patent engine creates a vacuum by the alternate admission and combustion of carbonick oxyde gas, which he makes from water and coke.

Butter melts at 96 degrees. It is formed by the act of churning and is not suspended or diluted in the cream, but is generated by contact with the air or some peculiar combination.

Forty grains of mercury and ten and a half of chlorick gas form *calomel.*

Carmine is made from cochineal.

Carbonate of soda is formed by passing a current of carbonick acid into a solution of soda, and it becomes a hard solid mass. Its crystals are octahedrons, with prismatick apexes. Carbonate of potash is made like the other with potash instead of soda.

Caoutchouck, or Indian Rubber, is

formed of a gum which exudes by incision from two plants which grow in Cayenne and the Brazils, called *hævia caoutchouck*, and the *jatiopha elastica*. The resinous substance, as it hardens being formed round clay moulds. The *urceola* which grows in the Indian seas also affords this gum as well as some other plants. Its specifick gravity is 0.9335. It is very inflammable; when distilled it gives out ammonia, water, oil, and charcoal. In South America they make with it bottles, boots, torches, and also balls to play with.

White oxyde of lead is *ceruse*.

Carbonate of lime is *chalk*.

Civet is an excrement taken from a glandular receptacle near the tail of the civet cat, chiefly the male; and they are kept and fed so as to increase the secretion.

Chlorine gas destroys the volatile effluvia of putrefaction and infection; and a solution of the chloride of lime, is bleaching powder, and employed for this purpose. A table-spoonful, in a wine-glass of water, spread on a plate destroys all infection, and purifies the air of sick chambers, infected houses, removes smells from drains, privies, &c.

The *charcoal* used in gunpowder is distilled in iron vessels, from willow, alder, and some other woods. 100 parts of oak make 22 of charcoal; of beech 20; of deal 19, glossy black; of elm 19½, black; of ash 18, glossy black; birch 17, rich black.

100 parts of shavings of dry wood produce one-fourth of *charcoal* by slow combustion.

Chocolate is a preparation from the cocoa-nut, which is ground into powder made into cakes, and flavoured with spices.

A *chromate* of potash and ammoniacal sulphate of copper form the coloured transparent liquid with which apothecaries illumine their shops.

21 cubick inches of *chlorick* gas and 40 grains of mercury, form corrosive sublimate.

Green oxyde of *copper* is the rust of copper.

Acidulous tartrite of potash is *cream* of tartar.

Cream is the lighter unctuous part of milk which rises to the top; and by churning it is further separated into butter and buttermilk. Milk, when sour, may be fermented, and it will yield a vinous liquor; and also take the acetous fermentation. Its constituents are water, oil, curd, gelatine, sugar of milk, muriates of soda and potash, phosphate of lime and sulphur. The cream is thickest in the milk of the cow, goat, and ewe. In women and asses it is whiter and thinner, affording less cream and soft butter. Mare's milk is like cows', but it affords less cream and poor butter.

Chloride of lime is the bleaching powder. Strata of slacked lime are exposed to the action of chlorine gas, in chambers; and the lime absorbs the gas, which, of course, gives out much heat, and forms a white powder that destroys all colours.

One part of mercury and two of sulphur become *Æthiop's mineral*, now called sulphuret of mercury. When this is exposed to a red heat it forms cinnabar, which is the vermilion used by the ladies. It consists of 85 parts of mercury, and 15 of sulphur.

The *eau de vie* of the French is white brandy, distilled from wine.

Enamel is made of powdered glass, oxyde of lead and tin, and salt of tartar, with coloured substances.

Substances which chymists cannot analyze are called extract, or the *extractive* principle, and it appears in vegetable substances chiefly. The red of madder and the yellow of weld, is called extractive principle.

The *eudiometer* is founded on the principle that the oxygen in the air combines with nitrous gas by which the bulk of the air is diminished in various degrees, so as to measure the quantity of oxygen previously combined with the azote.

To prevent mischief from *explosion* in chymical experiments, it is usual to wrap the vessels in cloth.

A candle makes a distinct flame in the *flame* of alcohol.

Fulminating powder is 3 nitre, 2

potass, 1 sulphur. Preparations of gold, silver, and mercury are also fulminating.

There are three kinds of *fermentation*, the vinous, acetous, and putrefactive, which generally succeed each other. The *vinous* fermentation arises from the saccharine principle in sugar or malt. When sugar only, yest is necessary. At 32 deg. it stops, at 50 deg. is slow, and at 70 becomes acetous. The gas disengaged is carbonick acid, carbon being carried off, and the atmospherick air being not absolutely necessary. Flavour arises from essential oils, and intoxicating properties from alcohol. Thenard thinks that the carbon of yest abstracts the oxygen, and then the hydrogen and carbon of the sugar combine with the hydrogen and nitrogen of the yest. The *acetous* follows the other, and the presence of air is necessary, and chymists conceive that the oxygen of the air combines with the carbon of the vinous fluid. The temperature rises to 85 or 90 deg. The *putrefactive* affects all animal and vegetable substances. Air and heat are missing. Vegetables give out hydrogen and carbon, and under water the hydrogen only, and the residuum is charcoal; but in air the carbon becomes carbonick acid. Animal substances evolve the same —and ammonia, also sulphur and phosphorus in their unpleasant odours.

Fluxes, in a large way, are lime or spar, and in the small way alkalies, as nitre and tartar.

The *foil* of looking-glass is tin and quicksilver. Globes are foliated by the addition of quicksilver and lead.

Gin is malt spirits, flavoured with oil of turpentine, combined with various substances. Geneva or Hollands is made from wheat, and flavoured with juniper berries.

Gems consist of silex, lime, and oxyde of iron. The ruby, sapphire, and topaz are essentially the same, but so distinguished by dealers from their colours, &c.

Glass is formed by combining, in a state of fusion, fixed alkalies with silica, and the occasional addition of litharge, oxyde of iron, or manganese. That called flint glass is made of fixed alkalies, calcined flints, and litharge or oxyde of lead. Ground glass is made of fixed alkali and siliceous sand, with oxyde of iron for a green tinge, or oxyde of manganese for a purple tinge. Bottle glass consists of lime fused with silica and allumina, with iron and manganese.

Flint *glass* is generally made of 100 sand, 6 red lead, and 3 pearlash, with some manganese to correct the green colour.

Plate *glass* is made of 43 sand, 26.5 sub-carbonate of soda, 4 quicklime, 1.5 nitre, and 25 broken glass, which make 75 of glass.

Crown *glass* is made of 50 sand and 110 kelp.

Bottle *glass* is made of soap-boilers' waste and river sand; or of sand, lime, clay, and sea salt.

Oxyde of cobalt tinges *glass* green; oxyde of iron or copper, green; of manganese, violet; of iron and copper, red; of gold, purple; of silver, yellow; and of arsenick and zinc, white.

Gallick acid is the astringent principle. It is formed from nut-galls, a substance formed on oak trees.

Glue, size, and isinglass are various forms of animal gelatine. Carpenters' glue is made of the skins of animals; and old animals make the strongest glue.

The violet rays of light tend to produce *green* colour, by decomposing carbonick acid.

Gum Arabick is obtained from a species of mimosa, called nilotica, a native of Egypt. The gum tragacanth is a native of Crete, and more adhesive than gum Arabick.

Gum consists of the same as sugar, with two tenths more oxygen and less carbon.

The Chinese are said to have invented *gunpowder* soon after the Christian era, and to have used it in cannon. In 1249 an Arabick author describes its use in fireworks and shells; and it seems to have been used in Europe in ordnance at the beginning of the 14th century. The Chinese use the same proportions as the English government, which is,

75 of nitre,
10 of sulphur,
15 of charcoal.

In France, the proportions are,
77 of nitre,
9 of sulphur,
14 of charcoal.

The gaseous products of 100 grains are 91 cubick inches, and the solid products 54 grains. The gases are azote 42 inches, carbonick acid 30 inches, carbureted hydrogen 9, sulphureted hydrogen 4, nitrous gas 6, making 91; and the solid contents are 40 grains of sub-carbonate of potash, 11 of sulphate of potash, 3 of charcoal, and ½ of sulphur.

The explosive force of *gunpowder*, as compared with the pressure of the atmosphere, is estimated at from 1000 to 2000 atmospheres. A cubick inch produces 236 inches of elastick fluid, and if rammed into half its space, it produces 472 inches of gas.

Gunpowder does not explode by heat at less than 6000 of Fahrenheit. Its force of explosion, when closely confined, is 6½ tons to a square inch. When the air is dry it discharges a bullet 1700 feet in a second; and when very damp, but 1200 feet. 10 parts of tin and 100 of copper make gun metal or brass guns.

Hungary water is made by distilling 2 lbs. of rosemary with two quarts of spirits of wine.

Hydrogen and carbonick oxyde absorb half their volumes of oxygen.

Hydruret of phosphorus inflames spontaneously, and fixes much oxygen.

Jade is a species of talc, and used by the Hindoos and Chinese for god-making.

Indigo is prepared from the leaves and small branches of the *indigofera tinctoria*—of which there are two varieties. It is also prepared in England from *merium*, and isatis or woad. It is the blue, or sulphate of indigo, of the dyers, and a very important article.

The scales on hot *iron* arise from the absorption of oxygen, and are called black oxyde.

Carbonate of *iron* is the rust of iron.

100 grains of *iron* burnt in oxygen gas increase to 130, with great heat and flame, proving the compound nature of the metal.

Isinglass is made of the sounds of sturgeons, a fish which sometimes is 18 feet long and 700 lbs. weight.

White *lead* is made by exposing sheets of the metal to fumes of vinegar. Arbor saturni is made by suspending a piece of zinc in acetate of lead. Solder is two of lead and one of tin. All preparations of lead are deleterious. When wine is sweetened with litharge, it may be detected by sulphureted hydrogen, in a black precipitate. Ores of lead in veins occur in siliceous rocks, and sometimes in calcareous.

The best candles for *light* are those made from vegetable tallow and wax, or cocoa-nut; and the whitest light is produced from the last or from vegetable oils, duly purified, as in France.

Light arises from the heat of the carbon, &c. in connexion with the combining gases, for these alone give little light; but by their condensation afford the intense motion which disperses the carbon as light.

The flashes of torches used on the stage are made by the fine dust, or seeds of *lycopodium*, or club moss.

Light matches are made of phosphoret of sulphur.

Liquor of flints, or silicated alkali, is two or three parts of potash with one of silica.

Litmus is made from the archil lichen. Acids turn its purple to red, and alkalies the red into blue.

Crystallized carbonate of *lime* is calcareous spar.

One grain of sulphate of *lime* will render 2000 grains of soft water hard.

Fluate of *lime* is fluor spar.

Lunar caustick is nitrate of silver.

4 lbs. of oak bark make 1 lb. of *leather*, but 1 lb. of catechu earth is equal to 8 lbs. of oak bark.

Lamp black is prepared by burning resinous substances in close rooms, and collecting the smoke on woollen cloths, which are brushed; and to expel the oil from this soot, it is heated to redness in an iron vessel.

Madder is the root of the *rubia tinctorum*, which grows in Europe. It gives a deep red dye, susceptible of changes by alkalis, &c.

Manure owes its stimulating power

to salts of ammonia, or volatile alkali. Human soil affords three times as much as that of any animal.

The regulus of *metals* means the pure metals.

Mercury imbibes one fifth per cent. of oxygen, and becomes a black powder, and by further oxydation it becomes a red precipitate; it then contains ten per cent. of oxygen.

Two of copper and one of tin make concave *mirrors* for telescopes.

Minimum or red lead is a double or deutoxyde of lead made from the protoxyde or *massicot*. Specifick gravity 8.9, and 90 lead with 8 oxygen. Lead ore generally contains silver.

Mosaick gold is the peroxyde of sulphur and tin.

Musk is a secretion of certain species of deer, and accumulated in a bag the size of a small egg and hanging from the belly. For this trifle they are in Thibet hunted and slaughtered by thousands. Canada contains a rat the size of a rabbit with the habits of the beaver, which secretes a musky fluid near the tail, and is a victim to avarice, which makes from 25 to 50*s*. per ounce of the article. There are also musk seeds the size of a bean.

Morocco leather is goat's skin.

The *narcotick* principle in the white poppy produces opium which is its concrete milky juice.

The *nails* are coagulated albumen and phosphate of lime.

Naphtha is fluid bitumen; petroleum, viscid bitumen; and asphaltum is hard bitumen. It is combined with vegetable substance in coals.

The *nitrogen* in animal substances distinguishes them from vegetables. In decomposing after death, vegetables display their oxygen by their acidity, and animals their nitrogen by their alkalinity, by forming ammonia.

Nitrick acid is spirit of nitre.

The breathing of *nitrous* oxyde gas produces exhilaration and a species of intoxication.

Nitrick acid is aquafortis.

Nitro-muriatick acid is aqua-regia.

Oils are found in eighty or ninety plants or trees, as the olive, linseed, aloes, rape seed, *carstan*, and from the *ricinus communis*, &c. Wax is produced from the myrica cerifera which flourishes in North America. It is green, burns with a white flame, and the shrubs yield from 5 to 7 lbs.

Expressed *oils* are animal and vegetable and are called fixed oils; their specifick gravity varies from 0.9 to 0.97; they boil at 600 degrees. Exposed to the air they absorb oxygen and become solid as transparent drying oils, or opaque fat oils; if burnt and rendered viscid they make printer's ink; with fixed alkalis, fat oils.

Volatile or essential *oils* are distilled with water from vegetable substances, of which they constitute the fragrance; the specifick gravity of oil of turpentine is only 0.792, while that of sassafras is nearly 1.1. They consist chiefly of carbon and hydrogen and evaporate rapidly in open vessels.

Rancid *oils* convert vegetable blues into red.

Olifiant gas or hydruret of carbon absorbs three times its volume of oxygen, and forms twice its volume of carbonick acid. Water absorbs eight times its volume of oxyde of chlorine.

Four grains of *opium* are equivalent to a tea spoon or 100 drops of laudanum.

Opodeldock is a solution of soap in alcohol, with camphor and volatile oil.

Pakfong is a mixture of 118 zinc, 5 copper, and 13 nickel.

Parchment is prepared skin of sheep or goats.

Pearlash—potash or subcarbonate of potash, is obtained from the ashes of burnt wood or vegetables; thus, 1000 lbs. of wormwood ashes produce 743 lbs. of potash, stalks of sun-flower 349, fermitory 360, beech 219, &c.; the ashes are boiled and the lie is evaporated in iron pans. American ashes are thought the best.

Pearls consist of concentrick layers of carbonate of lime and membrane.

Pearls and mother of pearl are

procured from the mytilus margaritiferus, a muscle of the Indian seas, about eight inches long.

Pewter is tin alloyed with a 20th of copper, and generally with proportions of lead, zinc, bismuth, and antimony.

In 1782, Dr. James Price of Guilford, pretended to have discovered the *Philosopher's* stone, and published an account of his experiments, but being a fellow of the Royal Society, he was required on pain of exclusion to repeat his experiments before Messrs. Kirwan and Woulfe, but after some equivocation, he took poison, and died in August 1783. He presented specimens of his gold to the King and the Royal Society, and pretended that they were made by a red and white powder.

Phosphorick acid is a very abundant substance combined with lime, and composes mountains in Spain, &c. It also abounds in ores and animal substances.

Pinchbeck is 3 zinc and 4 copper.

Potassium is formed by exposing a hydrate of potash to a voltaick circle of 500 double plates of four inches, when the substance appears at the negative pole, oxygen being developed at the positive pole. It is also made by melting potash with iron turnings in a gun barrel.

One thousand parts of spirits of wine have, by mechanical force, been *pressed* into 934, olive oil 952, rain water to 954, and mercury to 997.

The most powerful known poison is *prussick* acid, called hydrocyanick, and formed from iodine, cyanuret, and mercury. The acid in a state of vapour at a moderate heat fills the retort and condenses. A single drop put on the tongue of a large dog kills it instantly. It appears to destroy the nervous system. It reddens vegetables, and its constituents are two volumes of carbon, one of hydrogen, and one of nitrogen; it may also be extracted from bitter almonds. *Prussick* acid is also obtained from green tea, and souchong is as effectual in poisoning flies as arsenick.

Prussiate of iron is Prussian blue.

Sir John Pringle determined the power of various salts to arrest *putrefaction* or decomposition as under—

Sea salt	1
Vitriolated and soluble tartar, and mindererus	2
Sal ammonia and saline mixture	3
Nitre, hartshorn, and wormwood	4
Borax	12
Salt of amber	20
Alum and myrrh	30
Bark	120
Camphor	300

But *pyroligneous* acid or condensed steam of green wood baked in an oven is the most powerful antiseptick known; and the smoke of wood fires and charcoal act on the same principle.

Ratafia is spirits flavoured with kernels of different fruit.

Realger is a red combination of 80 arsenick and 20 sulphur. Orpiment is another combination.

Rennet is the inner coat of the stomach of young animals, generally that of the calf. It coagulates milk and produces cheese.

Tartrate of potash and soda is called *Rochelle* salt.

Saliva contains saline matter and albumen, and gastrick juice has the same constituents. The *chyme* in the stomach is converted into *chyle* in the small intestines, by mixture with bile and pancreatick secretion. In some animals it has been examined, and is a white fluid, with a sweetish taste and coagulates. Its principal component is albumen, and the serous part is like sugar of milk; in animals that feed on vegetables it is more transparent, and the coagulum is more albuminous. It is absorbed by the lacteals, and being mixed with lymph is carried into the venous system.

All the metals are formed into *salts*.

Thus, there is muriate of gold, which, with tin, makes the purple of Cassius.

Nitrate of silver, called lunar caustick.

Nitrate of copper, which detonates.

Acetate of copper, called verdigris.

Sulphate of zinc, called white vitriol

Tartrate of potash and antimony, called tartar-emetick.

Muriate of cobalt, which is sympathetick ink, being without colour when cold, but turning green when held to the fire.

Antimony and chlorick gas form butter of antimony.

The quality of *saltpetre* is inversely as the angle of refraction, and 5 deg. is called par. 1 per cent. is allowed for every degree above.

Salt of sorrel, or super-oxylate of potash, is what is called *salt of lemons*. It dissolves the oxyde of iron in the ink.

Salt of tartar remains dry at the top of very high mountains, though it liquifies at their base.

Salt cracks in the fire owing to water in it being vapourized.

All cattle thrive best if supplied with *salt*. Horses will consume 6 oz. daily, cows 4, and sheep ½. It is used as a preventive of the rot.

Unknown *salts* are determined to be nitrates by mixing them with muriatick acid, when chlorine is evolved.

Muriate of ammonia is *sal ammoniack*.

Carbonate of potash is *salt* of wormwood.

Shagreen is the skin of the houndfish, called the shagree.

Chamois leather is the skin of the chamois goat.

Shells consist of carbonate of lime and animal gluten.

Soda water is made by combining eight times its bulk of carbonick acid gas, formed in the process from chalk and dilute sulphurick acid, to which is added some carbonate of soda.

Muriate of *soda* is table salt.

Soap is chiefly made of kelp, or the ashes of sea weeds dried and burnt in pits. Its refuse is used in making glass bottles.

The best *soap* is made of olive oil in the south of Europe. In England it is made of whale oil or tallow, and to give it a yellow colour rosin is added. Soft soap is made with potash, and hard with soda. *Soap* of ammonia is volatile liniment.

Waters which contain earthy salts decompose common *Soap*, and form a new soap, which is insoluble in water.

Spruce beer is made of water, treacle, and the essence of spruce.

Only two *Specificks* have been discovered in medicine, bark in agues and mercury in syphilis.

Variety in the constituents of *Soil* is essential to fertility. It is barren when nineteen-twentieths are of one substance; hence lime or marl improves sand or clay.

Water passed over wheat flour carries off all the *Starch*, which falls to the bottom, and leaves the tough substance called *gluten*.

Starch consists of 50 oxygen, 44 carbon, and 6 hydrogen.

Starch becomes sugar by boiling for 48 hours in 100 of water and 1 of sulphurick acid.

The liquor of burned *Sulphur* is sulphurick acid, and when combined with soda it forms Glauber's salts; with magnesia, Epsom salts; and with copper and zinc, vitriol; all sulph*ates* when the acid is strongest, or sulph*urick;* or sulph*ites*, when the acid is sulphur*ous*, or weak.

Sugar has latterly been clarified by boiling it at a low heat in vacuo. So the essential oils are purified at a low heat, and their odour preserved.

Sulphate of soda is Glauber's salt.

Sulphate of magnesia is Epsom salt.

Sulphate of allumina is alum.

Sulphate of lime is plaster of Paris.

Sulphuret of potash is liver of sulphur.

Saltpetre is nitrate of potash.

Super-acetate of lead is sugar of lead, and a solution of it is Goulard's extract.

Sulphate of iron is green copperas.

Sulphate of copper is blue copperas.

Sulphate of copper is blue vitriol.

Sulphate of barytes is ponderous spar.

Tannin, the principle of the sub-

stance used in the tanning of leather, is made from nut-galls, which are likewise a constituent of writing ink:—3 parts of nut-galls, 1 of log-wood, and 1 of green vitriol, boiled in water, making the best ink.

Tannin is found in nut-galls, bark, catechu, kino, sumach, and old fustick.

A test of genuine *Tea* is a grain and a half of sulphate of iron; genuine green tea has a bluish tint; bohea, a blackish blue. If adulterated, it is all colours.

Tin plates are made by cleaning iron plates with acid, and then dipping them in melted tin.

Tin, united with mercury, is the silvering of looking-glasses.

Tin and antimony are pewter.

Acetous acid is distilled *Vinegar*.

Sulphurick acid is spirit of *Vitriol*.

Sulphate of copper is blue *Vitriol*.

The chymistry of *Vegetation* consists in the decomposition of the aqueous solution of the soils, and recombination of the elementary constituents in the membranes, fibres, and cellular and vascular tissues in the bark, wood, pith, and marrow. The fine membranes forms mucilage, and in cells, chiefly hexagonal, pervades the whole plant. The chymical decompositions in plants are believed to be effected in the leaves, in which the sap is exposed to the action of the air.

Vegetables are composed of carbon, oxygen, and some hydrogen, with nitrogen; and they mainly produce gluten, farina, mucilage, oil, and sugar.

Among *Vegetable* secretion the milk of the cow tree is remarkable. It grows in barren situations in South America, but on boring exudes a copious supply of rich nourishing milk.

The chymical power of plants are proved by fuci, which thrive without roots; and the epidemdrimi grows, flourishes, and blossoms, when suspended in a room, merely by decomposing the air and vapour.

The maximum density of *Water* is at 42½ deg. and it expands as cooled to 32 deg., the freezing point; and in freezing further expands, so that a cubick inch of it has displayed a force of above 27000 lbs.

If *Water* is saturated with a third of its weight of salt, it will still dissolve sugar; and water saturated with carbonick acid will dissolve iron.

The difference between Thames and distilled *water* is as 1.0006 to 1. Rain water is equivalent to distilled water.

Water may be saturated with oxygen by the peroxide of barium. When, at the specifick gravity of 1.-45 it acts as a caustick on the skin.

Zinc and copper make brass, pinchbeck, Dutch gold, &c.

OPTICKS.

The ancients were familiar with the elementary principles of opticks, and Euclid and Ptolemy developed them in formal treatises. They appear also to have been acquainted with the use of convex and concave glasses; but the former do not appear to have been applied to spectacles till the 13th century. Roger Bacon about 1250 described telescopes and microscopes exactly, and yet neither were made till the beginning of the 17th century, when one Metius, at Alkmaer, and Jansen, of Middleburgh, made them about the same time. Another Dutchman of the name of Drevel soon after made microscopes. Galileo imitated their invention by its description, and made three in succession, one which magnified a thousand times; and having with these discovered Jupiter's moons and the phases of Venus, telescopes soon became very popular, and were improved by Zucchi, Huygens, Gregory, and Newton; and finally by Martin, Hall, Dolland, and Herschel. The famous microscope of Lewenhoeck consisted merely of small glass drops or spheres. Prisms were first used in Italy, and their powers developed by Grimaldi. The theory of the rainbow was explained by Descartes; and the solar microscope was invented by Dr. Hooke.

The *Galilean* telescope has a concave eye glass, and is clear and shorter than those of Kepler, with

Huygens' three convex eye-glasses to set the figure upright. The *Gregorian* reflector has a small concave speculum for the image, and a large one facing for the object, with an aperture in the middle. The *Cassigrain* has a small convex speculum instead of the small concave. In Newton's plan, the small speculum was plane at 45 deg. and the eye piece in the side, but Gregory's and the Cassigrain are preferred. Herschel's 40 foot is in Newton's form, with a tube of sheet iron. The eye-glasses with which it magnifies 6400 times, are one-fiftieth of an inch focus. His discoveries were, however, made with five feet achromaticks, and his great telescope was a toy: the mirror would not keep its figure. Dr. Brewster has suggested a great improvement by receiving the image through an achromatick prism, and so refracting it to the eye-piece, while it greatly increases the light.

In *Achromatick* telescopes, the colours of refraction through any single glass are corrected by combining glass lenses of different dispersive powers, as crown glass and flint glass. They were first made by More Hall about 1723, and were sold by Dolland in 1757. The object-glass is composed of two convex lenses of crown glass, and one concave of flint glass; or sometimes of one of each. The curvature, to be multiplied by the focal length of the whole, should be as follows:—

1st lens, convex crown 0.6087 . . 0.8696
2d lens, concave flint 0.4544 . . 0.6087
3d lens, convex crown 0.6087 . . 0.6087

With two glasses—

1st lens, convex crown 0.293 . 0.353
2d lends, concave flint 0.345 . . 1.148

or for 30 inches, 8 inches and 14.3 for the first; and 12.11 and 28.5 for the second lens, taking the specifick gravity of the flint glass at 3.354, and the ratio of refraction in the two, as 1 to 1.656. In eye-glasses, the concave should be crown and the convex flint; the first 0.64, the second 0.529; and the third 0.64 multiplied by the focal length: and in double eye-glasses, 0.32 and 0.529.

Only 45 of 100 rays reach the eye pure after two reflections by a telescope, and these by the eye-glass are reduced as 100 to 95, or to 42.

The speculums of reflecting teleseopes are 32 copper, 15 grain tin, 1 arseniek, 1 brass and 1 silver.

The magnifying power of a teleseope is the quotient of the focal length of the object-glass by the eye-glass, or one of the eye-glasses.

In Herschel's 40 foot reflector, the great speculum was 48 inches diameter, 3½ inches thiek, and 2118 lbs. and it magnified 6400 times.

In 1821, a 25 feet reflector, on the direct principle, was set up at Greenwich, by Ramage, of Aberdeen.

The relative aberration of glasses from a spherical figure is in a plano convex 4¼ times its thickness. A convex lens whose sides are 1 and 6, is 1.08 its thickness. An equal double lens is 1.57 its thickness.

The best form of a *lens* is a double convex, whose radii are 1 and 6. The 1 being towards parallel rays the aberration is but 1.07, but the 6 towards them makes it 3.45.

Spherical aberration is avoided by a lens, part of an ellipsoid, whose greater axis is the index of refraction, and the distance of the foci 1. The seeond surface being concave, whose centre is the other focus of the same spheriod. Also, if one surface is plane and the other part of a hyperboloid, whose greater axis is the index of refraction, and the distance of the foci 1.

The surface of a true concave mirror is a paraboloid. In reflecting telescopes the mirror is an ellipsoid.

The microscope enables us to detect animalculæ the 10000 of an inch long; and if half as broad and thick, a cubick inch would contain $10000 \times 20000 \times 20000 = 4$ millions of millions, yet moving and perfect.

The highest lenses of Lewenhoeck's microscopes were but the 20th of an inch. They magnified the diameter 100 times, and the surface 10000 times. The 59th of an inch magnifies the same 500 and 250000. An inch focus magnifies but 5 and 25, and a half inch 10 and 100.

The microseope detects globules with important functions in the blood, the chyme, the chyle the lymph, the milk, the pus, &c. It also displays globules equally active in vegetable organs. Animation ap-

pears to begin with a globule, called the *monas termo*, a transparent point visible with the microscope, and found among infusoria.

Newton, in 1671, measured seven colours in the prismatick spectrum, 18½ feet from the prism, and 10¾ inches long and 2⅛ wide. He determined the red to be 45, the orange 27, the yellow 40, the green 60, the blue 60, the indigo 40, and violet 80, parts of 352: the hole admitting the light being one-third of an inch in diameter. The light consisted of an infinite number of circles or shades, but those tints were so discriminated by him. Grimaldi had previously described the same colours and had discovered that the hole generates the same colours by passing near any bodies creating fringes within, and without a shadow.

In Newton's prism the sine of incidence being 50, the sines of the extreme rays were 77 and 78.

It has since appeared that the colours depend on the size of the hole; thus Drs. Young, Brewster, and others, find that a hole the 20th of an inch gives but four colours, red 16 parts, light green 23, blue 36, and violet 25 of 100 parts, with a stripe of yellow equal only to 1. Hence Newton's measure is incorrect. The dispersion is one degree.

The dispersive power and the proportion depends also on the substance of which the prism is made. In a prism of flint glass it is 0.48; of crown .033; but chromate of lead is .4; oil of cassia .139; fluor spar and crysolite but .322; water .335; and sulphurick acid .031. As to proportions, the mean ray in crown glass divides the green and the blue. In flint glass the boundary is much nearer the red; but in rock crystal it is much nearer the violet; and in oil of cassia nearer than in flint glass.

The red is least turned aside and the violet most, and these are called least and most refrangible. The *illuminating* power is greater between the yellow and the green. The violet approaches to blackness. —Light appears to be a constant consequence of combustion, or of the union of oxygen with excited hydrogen, under a vast variety of combinations with carbon and other matter.

White light is a compound of many degrees of excitement when passed through a prism, and thereby subjected to oblique refraction or reaction. These various excitements are separated into an oblong figure, the lower or straightest end of which is red, with shades to orange; then with shades to yellow; then with shades to green; then with shades to blue; then to indigo; and then to violet and negation.

In the prismatick spectrum, violet rays indicate *heat*, as 1, green as 4, yellow as 8, and red as 16; beyond the red, no peculiar action exists. Some philosophers ascribe the colours to this difference of intensity; and hence painters call blue cold, green soft, yellow rich, and red warm. Musicians have similar notions.

Herschel ascertained that the extreme heat of the spectrum was 1½ inch beyond the red end, but others say at the red end. Ritter and Wollaston found that the violet end, and beyond, blackened muriate of silver, and a little beyond, and when blackened at that end, it was restored to the red end. In violet, phosphorus emitted white fumes in the red, but was arrested in the violet. Morichini and Mrs. Somerville have magnetized needles in the violet rays. Dr. Wollaston added other facts, proving the deoxydating power of the violet end, and the oxydating in the red.

The extraordinary experiments of Fraunhofer make the red and other rays of the prism, in seconds, from

	Red	Other cols.	Dispersion
Crown glass . . .	361	1336	=1697
Flint do.	437	1726	=2163
Water	305	1398	=1703
O. turp., no violet	625	2060	=2685
Alcohol, do. . . .	395	1125	=1520
Sulph. ether, do.	380	1150	=1530

He found five colours, but only four in the last bodies; but he discovered that the entire spectrum was crossed by black lines, of which he counted 590 from the extreme red to the violet.

The polarized pencils of Iceland

spar gave the same colours as other light, and the same black lines.

The intensity of light was in the red 2, in the orange 30, in the yellow and green 100, in the blue 32, in the indigo 18, and violet 3.

Very thin plates of transparent bodies become coloured, and the thinnest black, so as to reflect no light; while, according to thickness, the various colours are produced. When convex lenses are used to produce these thin plates, by laying them on each other coloured rays are produced. The colours produced by reflection and transmission, taken from the centre, are as under, in perpendicular rays.

1. Black . . . . . White
2. Blue . . . . . Yellow
3. White . . . . Black
4. Yellow . . . . Violet
5. Red . . . . . Blue
6. Violet . . . . . White
7. Blue . . . . . Yellow
8. Green . . . . . Red

and so through seven series.

The thickness of one was the millionth of an inch, and in water $\frac{3}{4}$ths; and of 2, $2\frac{2}{5}$, and in water $1\frac{4}{5}$; and for No. 7, $15\frac{1}{3}$ millionth, and $11\frac{1}{3}$. They appear to be explained by the determinations of Dr. Young and M. Fraunhofer, and to arise from the extent of waves. Newton, in his characteristick way, ascribed them to fits of easy reflection and transmission!

As minute bodies make coloured rings, which increase inversely as the bodies, Dr. Young contrived an *Eriometer* to measure such bodies and small fibres. He thus determined that the seed of lycopodium is the 10500 of an inch, or 3.5 on his scale, every part of which is the 3000th of an inch. The atoms of milk were 3, or the 9000th of an inch; of human blood 7; of fibres of silk 12; of cotton 19; of Saxony wool 22; of South Down 25 to 39, coarse wool 60.

The colours of bodies depend on the size of their atoms and the chymical character of the local atmospheres of their atoms and interstices. Black has small atoms and absorbs light—white, large, and reflects it. Reds are of oxygen character according to Ellis, greens nitrogen, and violets hydrogen. Their minute parts decompose incident light, and absorb some and reflect others; an oxygen body combining with hydrogen, and reflecting red, and the contrary with others; thus a hydrogen atmosphere absorbs red, &c. and reflects blue, indigo, &c. and a nitrogen absorbs red and violet, and reflects green or white, orange or blue.

The colours of bodies are produced on the same principle as the colours of their plates, and are owing to the thickness or thinness of the atoms, so that the sizes of the atoms may be inferred from their colours on Newton's data. To greens he assigns atoms the 15 millionth of an inch. To scarlets the 19 millionth. To oranges the 17 millionth. To yellow the 16 millionth. Vegetable greens the 25 millionth. Blues and purples the 14 and 12 millionth. Sky blue the $2\frac{3}{5}$ millionth. Pure white, as silver, the 5 millionth. Other whites are from 15 to the 25 millionth. Black varies from $\frac{1}{2}$ to 2 millionths of an inch. This theory of Newtons' seems to stand.

Late experiments of Mr. Ellis prove that the green colour of plants arises from their nitrogen character, that red colours arise from oxygen, and indigo and violet from hydrogen.

Solar light blackens muriate of silver, but in the spectrum the violet, purple, and blue rays effect it in 15 seconds, and the red only in 20 minutes, and the effect is more rapid beyond the violet end. Gum-guiacum is said to show contrary effects.

Buffon combined plane glass mirrors only 6 inches by 8, and with 40, set on fire a tarred beech plank 66 feet distant. With 98 at 126 feet; with 112 at 138 feet; with 154 at 150 feet; with 168 at 200 feet; and he melted all the metals at 30 or 40 feet.

Concave burning mirrors have been made of great size and power. They concentrate the sun's image at half the focal length. One of 4 feet diameter made of copper and tin, melted iron ore in 24 seconds, a sixpence in $7\frac{1}{2}$ seconds, a halfpenny in 20 seconds, tin in 3 seconds, cast

iron in 16 seconds, and slate in 3 seconds. Water boils immediately and evaporates, wood flames in a moment, pumice stone becomes glass, earth yellow or green glass.

The full moon produces no heat.

Concave wood or pasteboard, gilt and polished makes as good a focus as metal.

Parker made a glass lens 3 feet in diameter with 6 feet 8 inches focus and 3¼ inches thick at the centre. It fuses slate in 2 seconds, pure gold, platina, nickel, and cast iron in 3 seconds, pure silver in 4 seconds, pebble, barytes, and lava, in 7 seconds, steel and bar iron in 12 seconds, limestone in 55 seconds, volcanick clay, Cornish moor stone, and rhomboidal spar in a minute.

Gold retained its metallick state though exposed for hours. Wedgwood's pyrometrical clay ran into white enamel in a few seconds. The lunar rays gave no heat.

The rays were concentrated about 4000 times if the focus was the quarter of an inch in diameter.

One of the most curious speculations in natural philosophy is that of concentrating or multiplying the heat of the sun by plain mirrors, concave mirrors, or convex lenses. As one plain mirror reflects the heat of the sun, so the reflection of two, three or more augments the heat. In this way Archimedes burnt the Roman fleet at Syracuse; and Antheonius, an architect at Constantinople describes the method, and so does Leonard Digges, who wrote on it in the reign of Elizabeth and asserts that he fired bodies half a mile distant.

A plain mirror of half the length shows the whole body.

The crystalline lens in the human eye is composed of thin laminæ. At 25 the edges begin to be yellow, and at 80 the whole is like amber.

The optick nerve enters the eye .11 of an inch from the axis of the eye on the nasal side. The axis is .91. The pupil varies with light from .13 to .27. Focus of the cornea and crystalline .69. Angle of vision taken in by the fixed eye 110 degrees. Diameter of a female crystalline taken by Dr. Brewster .378, thickness .172, refractive power 1.384. Refractive vitreous humour1 .34, and aqueous 1.336.

The smallest visual angle is half a minute, and its size on the retina the 8000th of an inch.

Light is 8 minutes 8 seconds in its transmission through the distance from the sun to the earth, and in this time the earth in its orbit moves 20 minutes of a degree, creating an aberration from its true place.

Light is an effect of various excitements besides combustion. Friction produces it, and phosphori produce it, snow, diamond, the Bologna stone appear to absorb and radiate it; some combinations evolve it, and some plants give flashes. Rubbing the eyes in the dark, and their inflammation produce flashes of light. Slacking lime produces light and great heat.

Fraunhofer has determined the breadth of waves of light to be as under, in parts of an inch,—

Red	.00002582
Orange	.00002319
Green	.00002073
Blue	.00001912
Indigo	.00001692
Violet	.00001572

The intermediate spaces are black, or when the waves mingle they are light. In various colours, therefore, no microscope can exhibit an object less than half those measures.

Dr. Young maintains that light is the affection of a continuous medium so rare and elastick as to permit bodies to move through it without resistance.

Roemer proved the velocity of light to be 200000 miles per second by the accelerations and retardations of the eclipses of Jupiter's moons as nearer or more remote in Jupiter's orbit.

Light in passing through bodies does not increase their temperature and adds only to temperature in opaque bodies, or in proportion to opacity.

If the quantity of light when the sun is vertical be taken at 750, at 75 degrees it will be 742; at 60 degrees 718; at 45 degrees 666; at 25 degrees 507; and at 10 degrees 200.

The theory of the rainbow was

accurately developed by Kepler and Descartes in diagrams, just such as now appear in books. Father Grimaldi had ascertained the powers of the prism, and published a book relative to its peculiar phenomena; and Newton, in repeating these experiments, made several valuable inferences, and pursued the subject so as to confer on optieks the character of a science.

The inner rainbow has an angle of 41 degrees from the centre of the solar axis, and is 1 degree 46 minutes from *violet* to *red;* the outer bow is 52 degrees, and 3 degrees 12 minutes wide from *red* to *violet*. Or, the outer rainbow is 52 degrees to 55 degrees, and the inner 40 degrees to 42.5 degrees, the colours in the two being reversed.

The horizontal moon and sun surprise by their apparent magnitude, but all magnitudes are increased in the horizon; the first 5 degrees are apparently to the eye equal to 10 or 15 at 50 or 60 degrees of elevation, and the first 15 degrees fill a space to the eye equal to a third of the quadrant. This is evidently owing to *the habit of sight*, for with an accurate instrument, the measure of 5 degrees near the horizon is equal to 5 degrees in the zenith, and if the angle of the sun or moon be taken, either with a tube or a micrometer, when they appear to the eye so large in the horizon, the measure is identical when they are in the meridian, and appear to the eye and mind to be but half the size. There are two causes for this mistake, one, that we infer distance from intervening objects, and also size from brightness; and the angle being the same and the brightness less, the mind treats it as an object farther off, but of a given size, and therefore sees it larger.

Transformation of visual colours:

A square of red, long viewed, produces a light green border, and afterwards a square of light green,—

White produces black, and black white.

Red, blue·····purple, green
Blue, yellow····green, red

A wheel painted in prismatick proportion requires 80 degrees violet, 40 degrees indigo, 60 degrees blue, 60 degrees green, 43 degrees yellow, 27 degrees orange, 45 degrees red; and if any colour is taken out and the wheel turned, the remaining colour is a transformed colour as above. It is ascribed to the subsequent sensibility of the nerves first affected, by which they, as it were, take no cognizance of the same colour when mixed with others. It is altogether a curious subject and ably discussed in Brewster's Cyclopedia. In general, the new colour is removed half way in the spectrum, as though there were two spectra one beginning at the middle of the other.

Refraction appears to be a variety of reflection, and a continuity of reflection, from atoms to atoms in a medium called transparent. The light illumines the whole mass, but a principal ray prevails, and the law of the reflections is called the law of its refraction.

The sine of the angle of incidence being one, the sines of the angles of refraction are in constant ratios, as under, in the following bodies:—

Chromate of lead	2.974
Diamond	2.755
Melted Sulphur	2.148
Glass, three lead, one flint	2.028
Glass, two lead, one sand	1.987
Glass, two lead, one flint	1.830
Glass, one lead, one flint	1.787
Glass, three lead, four flint	1.732
Glass, one lead, two flint	1.724
Oil of Cassia	1.641
Common flint glass	1.605
Quartz, ordinary ray	1.548
Quartz, extraordinary ray	1.558
Plate glass	1.542
Crown glass	1.534
Crown glass (common)	1.525
Oil of turpentine	1.476
Olive oil	1.470
Sulphuriek acid	1.440
Alcohol	1.374
Ether	1.358
Salt water	1.343
Crystalline humour,	1.384
Water	1.336
Ice	1.310
Tabasheer	1.111
Air	1.000276
Vacuum	equal.

The refraction of gases, air being 1, is per Dulong, oxygen .924; hydrogen .47; nitrogen 1.02; carbonick acid 1.526; olefiant 2.302; chlorine 2.628.

Hydrogen or inflammable sub

stances of equal density refract from two to seven times more than others.

Taking the atmospherick refraction at unity, then the refraction of

Oxygen	Arago	.....0.8616
Hydrogen..	Arago	.....6.61436
Do.	Berzelius	.....7.0335

According to Brewster, the index of refraction is the tangent of its angle of polarization.

Of 1000 rays of incident light on water at an angle of 80 degrees, 333 are reflected and the remainder refracted; at 60 degrees 65 reflected; at 40 degrees 22; and from 30 to 0 degrees 18. In mercury the reflection is 704 to 40 degrees, and even 666 at 0 degrees, double water at 80 degrees. Plate glass at 80 degrees reflects 412, at 60 degrees 112; at 40 degrees 34; and from 30 to 0, 27 to 25. At 75 degrees Lambert made the refracted and reflected light equal. White paper reflects half at 45 degrees, and water but 28 of 1000, and glass but 42. In glass mirrors 535 are reflected, and 465 absorbed or dispersed. In Herschel's mirrors two-thirds were reflected at 90 degrees.

Bodies which refract most, reflect most, or are more splendid. The local atmosphere which increases one increases the other.

Air at less than half a millionth of an inch thick, ceases to reflect light; water at three-eighths and glass at one-third. At 72 millionths air reflects white, water at 58 millionths, and glass at 50 millionths, according to Newton.

The double refraction, or double picture of an object, which is presented through calcareous spar, is ascribed by Huygens to light passing through those bodies in a spheroidal form instead of circular, as in other solid transparent bodies. His various discoveries in opticks were made about the year 1650; and he teaches, that light consists of undulations produced by luminous bodies on the fluid which fills all space. The same was the opinion of Euler and many others. Descartes ascribed it to a protrusion from atom to atom in the same universal fluid. Newton taught, that they were innumerable particles flowing and travelling from the luminous body with a velocity of a million of miles in five seconds!

Polarized light is never derived from the light of combustion, or any artificial flame; only by reflection, by transmission through plates, or through crystals, which produce double refraction.

The test of polarized light is, that it refuses to be reflected by the surface of a transparent body when it is incident at an angle of 56 degrees, and in two positions which are at right angles to each other, discovered by turning the surface round the ray. The angle of incidence for water is 52 degrees, 45 minutes.

All the light is reflected which falls on water at an angle of 48 degrees, 28 minutes; and at the angle of 53 degrees it is polarized. In common crown glass it is all reflected at 41 degrees 49 minutes; and polarized when reflected at 56 degrees, 45 minutes. Diamond, 68 degrees; air, 46 degrees; and rock crystal, 57 degrees 22 minutes.

It is rationally doubted whether the qualities assigned to light by some experimentalists of polarization, &c. &c. exist in the light, for all the circumstances may be as clearly explained by considering light as mere power, subject to simple reaction, and then varied reactions of different bodies, atmospheres and forms, are considered as producing the several effects.

Fraunhofer in his optical experiments, made a machine in which he could draw 32,900 lines in an inch breadth.

There are 7700 veins in an inch of coloured mother of pearl. Iris ornaments of all colours are made by lines on steel from 2000 to the 10000th part of an inch.

Impressions on the eye are permanently continuous which are repeated seven times in a second, and on this is founded the rotatory toy called the Thaumatrope.

Looming high, mirage, fata morgana, &c. arise from the air at different heights being of unequal refraction, by which, rays from distant objects are bent downwards to the eye of the spectator, so that ob-

jects below the visual horizon, or 17 miles at sea, are seen above it. A hot poker will display the same effect; or by looking at objects through liquids of different refractive powers in a glass vessel.

A difference of temperature of 3.6° in two places, creates irregular refractions between them.

Water obstructs one-half the perpendicular rays of the sun in 17 feet, and one-fourth in 34 feet; and only a 100-thousandth part reaches the depth of 300 feet; hence the bottom of deep waters is in total darkness.

When the sea is a blue colour, it is deep water; and when green, shallow.

A ball of lime ignited affords a very strong light, equal in the focus of a mirror to numerous argand lamps.

Reflection is in intensity, as the difference of refractive power in the media.

The smallest parts of bodies are transparent, and opacity is caused by multitudinous reflections owing to atomick spaces or interstices, vacant or filled with water or gas.

The smallest atoms are black or too small to reflect light, and this is the case when they are less than the 8-millionth part of an inch.

Bodies are transparent, says Newton, when the pores are so small as to prevent reflection.

The luminous appearance of the sea is ascribed to microscopick mollusca and the parts of dead ones, which adhere to bodies immersed. On a starlight night it appears like varied reflections of the stars from inclined surfaces.

Halos are occasioned by crystals of ice in the atmosphere, or small hail drops partly melted.

Halos are about 23½ degrees in diameter, or exactly double.

The film of a soap bubble about to burst is only about three-fourths of the millionth of an inch in thickness.

The photometer determines the quantity of sunshine at noon to be from 90° to 100° at midsummer, and in midwinter 25° to 28°. A northern light at noon, in summer is from 30° to 40°; and in winter from 10° to 15°. In gloomy summer weather it is from 10° to 15°, and in winter only 1°.

One of the most interesting exhibitions in London, is Carpenter's room of powerful microscopes, and a solar microscope, in Lower Regent Street.

ELECTRICITY, GALVANISM, MAGNETISM.

All electrical action is without the surface of what is called the conductor, or in the space between two opposed conductors; and a conductor is as powerful if made of gilt tissue paper as of solid gold. The conductor is, in fact, a mere boundary surface, the electrick action being in the space between two surfaces. The sparks are the mere effect of the distance of the intermediate space, being a minimum at the place where the spark is taken. The light of the spark arises from the recombination of the elements which have been separated. A brush always attends the discharge of positive electricity towards negative, and a star the contrary.

The bodies which conduct electricity, by becoming imbued with it, according to the old theory, or by resisting its action like water in metal pipes, according to the new theory, are as under:—

Metals,
Dry charcoal,
Mineral acids,
Dilute acids,
Metallick ores,
Fluids and water,
Ice to 13° below zero,
Vegetables and animals,
Smoke and steam,
Rarefied air,
Salts,
Vapours,
Natural earth and stones,
Powdered glass.

The bodies that are non-conductors, which on one theory receive no electricity, and on the other display its entire action, are oxydes and ashes, ice lower than 13° below Zero, hard silicious bodies, porcelain and baked wood, air and gases, dry skins and paper, cotton, feathers.

hair, wool, silk, gems, and vitrifications, glass, fat and wax, sulphur and resins, amber and gum-lac. Both series are arranged in the degree of their conducting and electrick power, for all are so in various degrees.

Gum-lac is the most perfect non-conductor, and an excellent coating.

Davy determined that substances which act distinctly upon each other electrically, are also such as act chymically. Of two metals, that which has the greatest chymical affinity for oxygen, acquires positive electricity, and the other negative; thus, zinc becomes positive with reference to iron, tin, lead, copper, silver, gold, platina, in the order in which they oxydate, and so with each as to the other. In contacts of acids with bases, the acids are negative, and the bases positive.

The scale of conductors ends with earths and stones, and of non-conductors begins with dry metallick oxydes and oils. A thread of gum-lac is the most perfect insulation, $1\frac{1}{2}$ inch being equal to 15 inches of dry silk thread.

No electrical excitement can be acquired by a body in the air, unless another body at a distance in the same air is in an opposite state; and the excitement depends on the surfaces, not on the substances of the bodies, being as powerful between silver paper, covered with gold leaf, as solid gold. These facts are fatal to all the theories about a fluid or fluids, especially as it appears by delicate experiments of Coulomb and Biot, that the excitement, whether positive or negative, is entirely on the surface.

Otto Guericke first observed the spark and light of electricity. Dr. Wall first noticed the resemblance of electricity to thunder and lightning.

The Leyden phial in electricity was discovered by Von Kleist, of that city, about 1744.

The best conductors for electrical machines are flat, and opposed above and below by others of equal size. The best conductors to preserve buildings are leaden gutters, with lead or copper ridges connected.

Experiments both in electricity and galvanism prove that what is called the positive wire or end, or positive electricity, acts like an acid on blue vegetable infusions, by converting them into red; and also what is called the negative end, has the effect of an alkali, and converts the blue infusion into green. In like manner, if the positive and negative wires are made to act in acetate of lead, the acid is neutralized by the positive end, while the metal is surrounded by the metallick particles. This is considered as a proof that what is called positive electricity is anti-alkaline in its character; and what is called negative electricity is anti-acidulous.

A simple galvanick circle consists of a plate of zinc and a plate of copper, with an acid solution between them. A power similar to positive electricity moving from the copper to the zinc. A compound circle is when the same combination is repeated any number of times. By the process the zinc is oxydated, and negative electricity is continually circulating from the zinc to the copper. The zinc end being called the positive, and the copper or silver end the negative pole; the effect really being from the copper to the zinc, because the two extra plates at the end of a compound circle are superfluous.

Though galvanick and electrical phenomena arise from the same cause, the separation of the acidulous and inflammable principles, yet fifty pair of plates scarcely affect the gold leaf electrometer, and pith balls will not diverge with much fewer than 1000, and then exhibit very slight actions and re-actions, commonly called attractions and repulsions.

The light of the stream which passes from the poles of the wires when pointed with charcoal, is in vacuo of a dazzling purple colour, in air various, and the heat is so intense that it melts platina, fuses quartz, lime, &c., and converts other refractory substances into vapour. If the battery consist of 100 pair of plates, about six inches square, the light is occasioned by the simple union of the two elements, because it takes place in non-combustible gases. All the parts of the apparatus partake of the increase of the heat, that at the poles being no more than the final development. Gold leaf burns with

a blueish white light; silver, green; copper and tin like gold; lead, purple; zinc, white, fringed with red; mercury is dispersed in splendid sparks. All the chymical changes which galvanism produces prove that its positive electricity is derived from the oxygen in the fluid, and the negative from the anti-oxygen principle, which chymists sometimes define as alkaline, and sometimes as inflammable. The zinc plate becomes an oxyde of zinc, and its hydrogen disengaged, producing a current of negative electricity, while the oxygen flowing to the surface of the zinc, produces a counter current. The copper unaffected is a mere conductor and reactor until it becomes coated with particles of the oxyde of zinc, carried to it by the hydrogen current. In the mean time the apparatus is surrounded with more oxygen than the zinc will appropriate.

If the positive end be put into a blue infusion it converts it to red; and the negative in another vessel, converts the blue to green; and the same characteristick effects attend the action on metals, while, as it is a case of identical restoration, its effect on intermediate bodies, like that of electricity, is very capricious. The intensity of action appears to arise from the fluid containing a higher proportion of the elementary causes than the air in the production of common electricity, while the volume is less.

The mechanical action is so intense, that it converts sulphurick acid into oxygen and sulphur, and other acids into their elements, carrying an opposite element to the opposite pole; and even decomposes earths, or gives them new characters.

The action is produced by the contrasted degree in which the metals are affected by oxygen; the highest is zinc, then tin, iron, lead, copper, silver, gold, platina, which latter are the lowest in oxygen assimilation. When alkaline solutions are used, the negative becomes positive, and positive negative; and iron in the last follows copper.

If water conducts 1, muriatick acid conducts 2.46, and acetick acid 2.4; and in equal quantities of galvanick action, they conduct in .4 of the time.

Mr. Morgan found that a perfect vacuum exhibited no electricity.

Pouellit conceives that the conducting powers of metallick wires are inversely as their lengths.

Davy's experiments depended on the nature of the galvanick power which he never considered, but by uniting the oxygen of the galvanism with the alkalis, he converted soda into a substance which he called sodium, and potass into potassium, a species of evanescent metallick atoms. Soda thus imbibed from the galvanism 2 parts in 7 of oxygen; and potass 1 in 6. Their specifick gravities to water, are as 9 to 10, and as 6 to 10, or double and treble that of cork.

The positive wire in galvanism combines with oxygen and chlorine, and the negative pole with hydrogen and nitrogen. Therefore the first two are called electro-negative, and the last two electro-positive, because they act on bodies contrary ways.

The grand electrical battery of Van Marum was 130 square feet. The galvanick battery of the Royal Institution consists of 2000 plates 4 inches square, or 222 square feet.

Oxydation of metals creates or accompanies electrical action. In the common machine the electricity is promoted by the oxydation of the amalgam, and therefore the best is made with tin and zinc.

It is stated that a machine acts as well in hydrogen gas and in carbonick acid gas as in atmospherick air, for like air, they are non-conductors of electricks.

When a discharge is made through a solution of sulphate of copper, the metal revives round the negative wire, and the effect changes as the wires are made positive or negative; the negative wire always separating oxygen from its combinations, and the positive wire effecting the union of oxygen with the bases. In solutions of neutral salts the earthy bases appear at the negative, and the acids at the positive wire.

Coulomb, by a series of very accurate experiments, determined that the action of magnets is reciprocally as the squares of the distance.

It appears by Barlow's Experi-

ments, that the power of a magnet as of an electrical conductor does not depend on the quantity or solid contents, but on the extent of surface presented to the air. Thus a piece of wood covered with thin layers of magnetick ore, and a conductor of silver paper, covered with gold leaf, are as powerful and efficient as magnets of solid ore, or conductors of solid metal of equal superfices.

The actions and reactions of the load-stone and iron were known to the ancients, but polarity was not discovered till the 12th century. The first mariner's compass was shown at Venice in 1260, by Paulus Venetus. In China it has been used from the earliest times.

By recent delicate experiments of Arago, &c. it appears that all metals as well as iron or nickel are non-magneticks; and in relation to electricity are like non-electricks, consequently the identity of electricity, galvanism, and magnetism as varied effects of common causes seems to be more closely established.

In 1662 the magnetick and terrestrial meridians coincided at London, but since that time the variation increased in 1818 to 24° 17′ west. When first observed at London, about 250 years since, the variation was 11° 15′ east, or one point. In Baffin's Bay it is from forty to fifty degrees. There is also a daily variation observed by Beaufoy of from 6 minutes to 15, and the greatest in summer. The sun seems, therefore, to generate the delicate electricity which produces magnetism.

The northern voyagers agree that there is a magnetick pole at about 70° north lat. and 90° W. long.; and Hansteen places another in 85° N. lat. and 101° E. long.

In Iceland the present variation is 40° west; and in Greenland 51° west; at Petersburgh 8° west; and so near as Stockholm 15° west; while at Christiana it is 20° west. On the western coast of America it is from 20° to 35° east.

The magnetick equator intersects the earth's equator, and gives no variation at 108 degrees, 125°, 175°, and 335°, reckoning westerly.

The curves produced round magnets by particles of steel dust, do not arise from any current, but each particle acquires a north and south pole; and if needles were employed, each would range itself in the direction of the curve, and be found to have acquired contrary poles.

Magnetick ore when found has no polarity, but acquires this property in the air, and then is capable of transferring it to bars of steel.

Every particle of the surface of a magnet has two poles, and the power at the ends is the accumulated power of all the atoms operating as by acceleration.

In north latitudes, the south pole of the magnet raises most iron and *vice versa*.

Every bar of iron which does not lie in the plane of the magnetick equator is essentially magnetick; or, in other words all particles of iron have a disposition, by some peculiar action and reaction, to range themselves in the plane of the magnetick equator. If a poker for example, be simply held perpendicular to the horizon, it will, as the result of its position, exhibit magnetism at both ends; and it will occasion the north pole of the compass to recede at its lower end and cause an approach to the south pole, and *vice versa*. If it be laid in the plane of the magnetick equator, no action and reaction will take place; or, if it be laid east and west in the line which intersects the plane of the horizon and the plane of the magnetick equators, no action takes place; but if while perpendicular to the horizon or parallel to the magnetick axis, it be struck at the ends with a hammer or vibrated by friction, then the magnetick action is facilitated or increased, and its affections on a compass are greatly increased. On the other hand, after being so excited, if struck, on being laid in the plane of the magnetick equator, the excitement instantly abates.

If a needle or small bar of iron be set on the end of the poker, and both are struck, the needle or small bar become at once a perfect needle, adapted to every purpose of a compass. These experiments are decisive of all the hitherto puzzling phe

nomena of magnetism. For if we suppose that there is some circulation in the plane of the magnetick equator, and that iron, as the only non-magnetick or impervious body, by reaction, produces a force tending to conformity, then there is no difficulty in explaining all the phenomena, and all the supposed attractions and repulsions of magnetism.

ASTRONOMY.

The British Museum contains the original work of Copernicus on the Solar system. Its title is—

"Nicolai Copernici Toriensis de Revolutionibvs Orbium cœlestium Libri vi.—Habes in hoc opere iam recens nato, & ædito studiose lector, Motus Stellarum, tam fixarum, quam erratiearum cum ex ueteribus, eum etiam ex recentibus obseruationibus restitutus: & nouis insuper ac admirabilibus, hypothesibus ornatos. Habes etiam Tabulas expeditisimas ex quibus eosdem ad quodius tempus quam faeilli me calculare poteris. Igitur eme, lege, fruere.

Norembergæ apud Joh. Petreium,
Anno M D XLIII.

It is dedicated—

Ad Sanctisimum Dominum Pavlvm III. Pontificiem Maximvm.

And there is a laudatory letter Nicolavs Schonbergivs, Cardinalis Capuanus, Nicolaro Copernico, S. dated Rome, calend. Novembris, anno M D XXXVI.

It is a small folio of 196 pages, full of diagrams, and well printed at the expense of the Cardinal.

The first recorded observatory was on the top of the temple of Belus; the tomb of Osymandias, in Egypt, was another, and it contained a golden circle 200 feet in diameter: that at Benares was at least as ancient as these. The first in Europe was at Cassel in 1561; that of Tycho Brahe was the second in 1576, at Uraniburg. The next was at Greenwich in 1675, and contains a transept circle by Troughton; a transit instrument of eight feet, by Bird; two Mural quadrants of eight feet, and Bradley's zenith sector. The telescopes are 40 and 60 inch achromaticks, and a six feet reflector: there is also a famous camera obscura; and Flamstead had a deep well now filled up. The Paris observatory was built in 1667; that of Berlin in 1711; that of Nuremberg in 1678; that of Bologna in 1714; and that of Pisa in 1730; that of Utrecht in 1690; that of Copenhagen in 1656; that of Stockholm in 1746; and that of Lisbon in 1728. Latterly every university has had its observatory; and there are also several private ones scattered over Europe and the United States. The latitude and longitudes of some of the principal observatories are as under:—

Greenwich	51°	23′	39″	First Meridian			
Paris	48	50	14	2	20	15	E.
Gottingen	51	31	50	9	56	30	E.
Berlin	52	31	45	13	22	15	E.
Dublin	53	23	13	6	20	30	W.
Edinburgh	55	57	57	3	10	21	W.
Upsal	59	51	30	17	39	0	E.
Petersbur.	59	56	23	30	18	45	E.
Pekin	39	54	13	116	27	45	E.

The Antiquity of astronomy depends on the following data:—

1. The Hindoos assert the record of observations 3102 years before the Christian era, i. e. 754 years before Moses's deluge in 2348 B. C.; and these observations agree with the most accurate modern tables, including the corrections of refined theory.

2. The Chaldeans had made observations which extended 1903 years before the taking of Babylon by Alexander, i. e. 2233 B. C., or within 100 years of Moses's deluge.

3. The Egyptians claimed 48853 years of observations which, by mistake, may have been called years, by Diodorus, instead of moons, and if so, this gives a date of 3900 years B. C.

4. Then the Persians go back to the period when Aldebaren was on the equinox, now advanced two signs 7° 20′, which would have been in 3018 B. C.

5. The Chinese assert that Fohi in 2753 B. C. constructed astronomical tables, and that in 2697 Hoangti made an armillary sphere and they record a conjunction of the five planets which really happened in 2449.

6. The Zodiack of Tentyra places the equinox in the middle of Aquarius which indicates an advance of two signs 15° since its formation, and carries us back to 3600 B. C.

The seienee must also have been long progressing to a state in which it reeorded these formal observations.

The earliest Hindoos praetised trigonometry and sexagesimal arithmetick, and taught that the earth was spherical, turned on its axis, &c. They then took latitudes and longitudes, knew the diameter of the earth to be 1600 yojanes, and the moon's distance 51570, or 32 diameters.

In one yug they say the Sun, Mercury and Venus, or Surya, Budha, and Suera make 4320000 revolutions.

The Hindoos call

The Sun	Surya,
Mercury	Budha,
Venus	Sucra,
Mars	Mangala,
Jupiter	Vrihaspati,
Saturn	Sani,
Moon	Chandra.

It seems probable that Aristarchus readjusted the zodiacal signs, for the present advance of 29 degrees carries us back 2088 years, near the age of Aristarchus. The Balance and Virgo determine the equinox and harvest, and accord beyond all question.

Bailly maintains, from oriental records, that astronomy was cultivated in Egypt and Chaldea 2800 B. C. In Persia 3209. In India 3101, and in China 2952.

Job, Hesiod and Homer mention several of the constellations.

The Royal Library at Paris contains a Chinese chart of the heavens made about 600 B. C., in which 1460 stars are correctly inserted. Besides the Pekin Gazette, the government publish an annual calendar, in which the lucky and unlucky days are inserted, and what may be done, and what refrained on those days. In their astronomy they divide the zodiack into 12 signs and 28 constellations; and time into periods of 60 years, instead of our centuries, and into revolutions of 10,800 years, introduced by Taotse 1500 B. C., and evidently referring to the revolution of the line of Apsides, when the Perihelion and Aphelion interchange their positions. They were very ancient topographers; we refer map making to the 14th century; but there exists a map of China made 1000 B. C., which nearly accords with the actual surveys made by the Jesuits in 1700 A. C.

The Astrologers of Babylon are stated to have presented Alexander with astronomical observations during 430000 years. But this was likely to be an error of ignorant reporters who mistook a celestial period fixed by multiplication for an observation. Twenty revolutions of the line of Apsides make up this period, and perhaps they, with the Hindoos, might maintain there had been 20, as matter of tradition or conjecture; or it means moons or days.

The Egyptians alleged, that in 48853 years, (probably moons) the period from Vulcan to Alexander, they had accurately observed 373 eclipses of the sun, and 832 of the moon.

The Persian astronomers recorded their observations 3000 years before Christ, when Aldebaran and Antares were in the equinoxes, and Regulus and the Southern Fish in the solstices, or exactly N. S. E. and W. which agrees with the preeession of the equinoxes.

The Phœnicians sailed by the stars in the Great and Little Bear.

In 2752 Fohi made astronomical tables, and in 2697, the fixity of the Polar Star led to the invention of the armillary sphere by Yuchi. In 2513 Chueni began his reign, and in his time the Chinese record the visible conjunction of five planets, which by calculation actually took place in 2449. All the fundamental elements of astronomical calculation appear to have been acquired by them long before the Christian era. In the 8th century B. C. they had a catalogue of 2500 stars. They divided the ecliptick into 365.25 parts, and made the obliquity 24°, which carries back the period 41 centuries, the secular diminution being 50″, or to 2200 B. C.

The Indian tables of great antiquity

make the tropical year within 1′ 53″ of our best tables. And other tables, equally accurate, appear to Bailly, Playfair, and other authorities, to have been constructed 3102 B. C. One of their zodiacks places Aldebaran 40′ before the vernal equinox; which carries it back to 3163 B. C. Other coincidences are astonishing, and prove the length of their observations by the perfection of their instruments in the epoch of Adam. Thus the place of the sun agrees with our best tables within 46′ 54″, and the moon within 37′ and our tables include various minute anomalies of recent discovery. The planets equally agree in minute particulars.

Demoeritus taught that the milky way was caused by innumerable stars. Nicetas and others taught the diurnal motion, while Pythagoras, who had been in India, taught the two-fold motions, and the modern system of the world. He ascribed eclipses to shadows, and arranged the planets as in the Copernican system. The later system of Ptolemy was his attempted improvement.

Pytheas, in 330 B. C., made the obliquity 23° 50′, and recorded the connexion of the tides with the moon.

Eratosthenes, in 276 B. C., made the obliquity 23° 51′ 20″. He and Hipparchus in the same age, Ptolemy in 130, the Arabians in 800 and 900, and Uhugh Begh, in 1440, perfected the outlines of the science, and prepared the way for Copernicus, who, in 1543, on the day of his death, allowed his system to appear. It is the system of the Chaldeans, and nearly the same that was taught by Pythagoras, and will be believed by wise men to the end of the world.

Tycho, Kepler, Galileo, Hevelius, Descartes, Gassendi, Newton, Huygens, Flamstead, Hook and Halley distinguished the next century, and though Bacon opposed himself to Copernicus, and preferred the Ptolemaick system and astrology, yet it triumphed, and its adoption has rendered astronomy the most perfect of the sciences. The hypothesis of Newton, formed in 1666, that bodies fall to the earth by attraction sustained by three other hypotheses about a universal gravitation, a projectile force in the planets, and a vacuum in space gave systematick character to the science. But Kepler's approximate law that the squares of the times are as the cubes of the distances, and Fermat and Hooke's law, that the forces are as the squares of the distances, will long survive Newton's, and all hypotheses.

Copernicus describes attraction as an appetite or appetence, which the Creator impressed on all parts of matter! Kepler describes it as a corporeal and mutual affection tending to union; and Newton as an original power which restores lost motion!

The whole system, and the motion of every planet and satellite has been reduced by the Editor to rectangles of matter and velocity, and proved to be exactly mechanical to the third and fourth places of decimals.

The law of diverging *force* from a central is as the number of atoms affected, i. e. as $\frac{1}{d^3}$; and not as $\frac{1}{d^2}$ which is a mere superficial radiation of light, not of momentum.

The apparent mean diameter of the Sun is 32′ 2″, of the Moon 31′ 26½″. The Earth as seen from the Sun is 17½″.

If the principle of terrestrial gravity prevailed at the sun, Dr. Young shows that a body would fall 450 feet in a second, and a man be two tons.

The horizontal parallex of the sun is between eight and nine seconds, and of the moon about 58 minutes.

The sun is in the exact centre of the solar system, but the planets vary their distances by moving between the tangent force and the chordal force, every where governed by the sun. As a planet is not in two places at once, an orbit and foeii are imaginary. The extreme distance is to the least distance 1017 to 973, 1000 being the mean distance of the Earth. The orbit is in the exact form of an egg, and not an ellipse or section of a cone.

On the first of January the sun's diameter is 32′ 35.6″, and is then in its perihelion, and on the first July is

but 31′ 31″ and then is farthest off, or in its aphelion.

The earth's orbit velocity is 98163, or 98160 feet per second; and its rotation from 1525.41 to 1525 per second at the equator.

The Sun is equal to 20610000 Mercuries, to 1520000 Venuses, to 1383000 Earths, 9394000 Mars, 973 Jupiters, 1399.4 Saturns, and 1595.5 Herschels.

The least hourly motion of the sun is 2′ 23″, and the greatest 2′ 32.9″.

The sun's rotation is 7418 feet per second, or 4.86 times the velocity of the earth's equator.

Owing to the simultaneous motion of the earth, the real rotation of the Sun is 25*d*. 9*h*. 56*m*.

The sun's declination, or the declination of the fifteenth degree of the signs, is as under:

♈ ♍ ♑ ♓ ·····	5°	15′	2″
♉ ♌ ♏ ♒ ·····	16	21	26 6
♊ ♎ ♐ ♑ ·····	22	37	32.9

This distance of the Sun from the Earth, taking a degree at 69.148 miles, at the equator, is computed as under, by the theory of motion, i. e. orbit = rotation × 4 × by fall of bodies.

Log. of deg. in 365101 feet	5.562412
× 360	2.556303
	8.118715
131455000 feet or 7924 miles diameter	4.935320
÷ 86163″ in a day	3.183395
1525.4 feet per ″ × 4 for sphere	.602060
	3.785455
6101.6 central force × fall per ″ 16.08728	1.206493
	4991948
98163 feet, orbit per ″ × seconds in a year	7.497960
	12.489908
Feet in orbit ÷ 6.283 . . .	.793180
	11.691728
Feet in distance ÷ 5280 .	3.722630
Log. distance in miles . .	7.969097

That is, the mean distance is 93131500 miles estimated by the ascertained fall of a body in a second.

But if the degree, as by former measurers, were taken at 68.75 miles, or 363000 feet, it would reduce the distance to 92572000 miles; and the rotation per second from 1525.4 to 1519.6; and orbit motion per second, to 97600.

It is commonly called 69½ miles, but 69 would be a more correct description for general purposes.

The distance estimated by the small parallactick angle varies greatly as the angle is taken. At 8.75″ it is 94 millions; at 8.6″, 95; and observers vary in so small an angle from .8″ to .9″, making a difference of 10 millions in the distance.

In 1779 Herschel measured a spot in the sun 50000 miles in diameter. These spots cross the sun from east to west, and perform a revolution in 27 days, 7 hours and 37 minutes, and show that the axis is inclined 3°45′ to the eastward.

Spots in the sun have been seen to divide and separate in many parts. They consist of a dark nucleus and a lighter border, which last is often seen by itself. Wilson and Herschel think the spots are holes in the luminous solar atmosphere, or in its clouds, and that the nucleus is the body of the sun. They, however, make notches in the sun's limb. When they disappear, they are succeeded by faculæ or bright spots. They are classed as openings, shallows, ridges, nodules, corrugations, indentations and pores.

Many maps have been made of the moon and Ricciolus and Hevelius assigned names to the several parts with latitude and longitude taken from lines drawn through the centre. One annual ridge, with a small central rock just S. W. of the centre, is called by one Hipparchus, and by the other, Olympus. A large spot, just S. E. of the centre, is called Ptolemus by one, and Mount Sipylus by the other. 10° 43′ E. and 43° S. is the deep brilliant cavity called Tycho, or Mount Sinai, the centre of all the radiations in the south hemisphere.

The height of the mountains in the moon is considerable; ten are 5

miles, or nearly; and eight are from 3 to 4 miles. Three of the hollows are from 3 to 4 miles; ten are from 2 to 3 miles, and as many are nearly 2 miles.

The dark parts are not supposed to be water, while the high parts are ridges of mountains or high lands. The brilliant spots are hollows surrounded with high ridges with a hill in their centre. This rough surface is considered as volcanick; and several observers, especially Herschel, have observed red spots like volcanoes. Of course combustion bespeaks an atmosphere, and observations on the horns prove that there is one the third of a mile high, creating a twilight, and a rarer one nearly a mile higher.

Some moderns estimate the atmosphere to be 1638 miles high.

The mass of the moon is to that of the earth, per La Place, &c. as 1 to 69.79, per the tides, on theory. But in bulks the ratios are 1 to 47.81.

The moon's motions are accelerated 11 seconds in a century; and in remote centuries as 11 × by the square of the number. Hence an eclipse 2000 years ago requires 20 × 20 × 11 seconds of time to be allowed, or 1¼ hour nearly.

The Chaldean period of 223 lunations, or 18 years, 11 days, 7 hours, 42 minutes, brought the moon within 28′ 10″ of the same position again as to nodes and longitudes; but 6890, or 557 years, 17¾ days, bring her within 1′ 41″, and then all her phenomena, eclipses, &c. &c. occur for the same period as before.

The moon's nodes or equinoxes go round the ecliptick in 6793 days, or in the Chaldean period.

The moon is 24 minutes longer in performing her orbit when the earth is in its perihelion than its aphelion.

It was a fatal error of Newton's in asserting that the moon falls but 16 feet in a *minute*. As matter of undeniable FACT it falls 128820 ft. in every minute, and has fallen 128820 feet in every *minute*, without exception or abatement, ever since it was a moon.

The moon's mean motion in her orbit is 3372 feet per second, and to produce this motion, the two forces at right angles must be 2146.9 feet, and this is her mean fall towards the earth in every second. In a *minute* it is 2146.9 × 60 = 128820 feet as the actual fall, and this agrees with the radius divided by the number of minutes in the fourth of a lunation. Now a body at the earth falls but 16.0875 feet in a second, and by acceleration for a minute but 58000 ft.; there is therefore no likeness whatever in the effects as has been imagined and often stated. Those who make the moon fall but 16 feet in a minute instead of 128820 feet, do it by making a *paper* orbit for the moon, and then they compare the paper orbit of their own invention with the real motion of the earth, instead of comparing one actual fact with another actual fact.

The moon increases in velocity 11″ in 100 years.

The exact interval of the moon's conjunctions with the sun is 29.5-305887 days.

The moon's diameter in apogee is 28′ 55.84″, and in perigee 33′ 56.″ Her equatorial parallax varies also from 53′ to 62′.

The moon's distance is computed as follows by parallax. This has been taken between 61′ 32″ and 54′ 4″; and La Place makes it 56′ 34.2″.

As sine 56′ 34.2″	8.21448
To radius	10
So is earth's semi-diameter	3.59748
	13.59748
	− 8.21448
241547 miles = ...	5.38300

Her size is determined by the angle which she presents, which is 31′ 26.5″.

As radius	10
To sine 31′ 26.5″	7.96118
So is log. distance	5.38300
	13.34418
	10
2209 miles = ...	3.34418

When the new moon is within 18 degrees of the node, there is an eclipse of the sun; and when the full moon is within 12 degrees of the node, she will pass in the earth's shadow and be eclipsed.

The harvest moon arises from the varied inclination of the Zodiack in rising and setting, and this makes a difference in the moon's rising of an hour, as 1 h. 17 minutes, or 17 minutes. In 1839 and 1857 there will be striking harvest moons.

The axis of the moon is inclined to the plane of her orbit 88° 17′.

The cube root of the square of a planet's period multiplied by 1.83, is its distance in millions of miles universally, P $\frac{2}{3} \times 1.83 = D$.

If all the known planets were assembled in one, it would be the 557th of the sun; and with equal force would be 590 millions of miles distant.

Lagrange demonstrated that the inequalities of the planetary motions are periodical. The lines of apsides and the periods being constant.

The period of a planet which moves but 500 feet in a second, would be 10 millions of years, and its distance 2400000 millions of miles, or $\frac{1}{14}$ the distance of the nearest fixed stars.

The Newtonian theory assumes that the matter of the planets vary in density, thus—Water being 1; the Sun is $1\frac{2}{4}$; Mercury, $9\frac{1}{6}$; Venus $5\frac{1}{15}$; the Earth, $4\frac{1}{2}$; Mars, $3\frac{2}{7}$; Jupiter, $\frac{1}{14}$, or equal to water; Saturn, $\frac{13}{32}$ rather heavier than cork; and Herschel, $\frac{99}{111}$, equal to water. Others reasonably allege, that all planetary matter must be of average density, and the new mechanical theory finds an exact accordance on the principle of equal density.

Herschel could see no spots on Mercury; but Schroeter alleges that he did, and saw mountains 10 miles high. He considers the rotation as $24\frac{1}{4}$ days.

Spots have been seen on Venus; but Herschel saw none, only a dense and enlightened atmosphere. Schroeter saw a mountain 22 miles high, another 19, and two others 11. He makes the rotation 23h. 20′ 54″. Many have believed that they have seen a satellite, distant $66\frac{1}{2}$ semi-diameters.

The enlargement of the light part of the moon, and the enlargement in the horizon, are optical illusions — one owing to bright objects enlarging pencils of light, and the other owing to the mind placing the moon at a greater distance, while the angle is the same.

When Venus is brightest, and at the same time at its greatest north latitude, it can then be seen by the naked eye at any time of the day. This happens once in about 8 years. *Vince.*

Mars and Mercury are the most eccentrick of the planets; that of Mars being 1-tenth, and that of Mercury 1-fifth nearly, Juno and Pallas are 1-fourth.

Mercury never moves above 28° from the Sun, and therefore never rises or sets above 1 h. 50 min. before or after the Sun, and is seldom seen.

There will be transits of Mercury,
May 4, 1832
Nov. 7, 1835
May 8, 1845
Nov. 9, 1848
Nov. 11, 1861
Nov. 4, 1868

Venus never goes above 48° from the sun, and is brightest at 39°. Both have phases like the moon.

There will be no transit of Venus till Dec. 8, 1874; but another Dec 6, 1882. No other till 2004.

The redness of Mars is ascribed to his dense atmosphere, and it appears to be higher than his own diameter.

There are bright spots at the north and south poles of Venus, which Herschel ascribes to Ice; and the appearances in the centre are odd and inconceivable.

The polar axis of Jupiter is $\frac{1}{14}$th shorter than the equatorial diameter, and in Saturn is $\frac{1}{11}$th, owing doubtless to their rapid rotation round their axes.

The first of Jupiter's satellites is twice as large as the second, and the third and fourth, 5 or 6 times larger than the first. The third is the largest.

As Jupiter's moons move by the action of Jupiter on the medium of space with forces inversely as the cubes of their distance, and reactions as their quantities, there is an amusing harmony in the arithmetick

of their motions, which La Place has developed in a series of propositions; and it thence appears that all cannot be on one side of the planet at the same time. Their actual sizes are undetermined, but as the circumferenee is equal to the falling back of the nodes, the sizes may easily be determined.

Saturn's ring is double, and the nearest is three times as broad as the other, one being 20000 miles broad and the other 7200, while the spaee between them is 2839 miles.

The exterior ring is 205000 miles in diameter. The inner ring is 33000 miles from the body of Saturn. It is said to rotate in 11h. 16m., and the outer part in 17h. 10m., but Schroeter doubts it. La Place is very hypothetical on this and other subjects, and therefore few of his calculations are to be relied on. The accuraey of mathematical results depends on the *rigorous* aceuracy of the hypothesis applied, and La Place is generally absurd, and very superstitious. Saturn swells towards the Poles, and the longest diameter is at 43° 20′, and to the equatorial as 36° to 35°, while the polar is 32°. This seems owing to the central action of the rings, for this vast planet turns in 10h. 16m., and the rings seem like the middle parts thrown off by a centrifugal force.

Five of Saturn's satellites were discovered in the 17th century, and the sixth and seventh by Herschel in 1789.

Ceres ought to be taken in the measures of Schroeter, for Herschel seemed disposed to underrate the new discoveries of other astronomers. Its diameter is 1624 miles. It was discovered by Piazzi in 1801.

Pallas was discovered by Olbers in 1802, and is 2099 miles. Juno by Harding, and is 1425 miles. Vesta by Olbers in 1807. It has been supposed that these planets are fragments of a large planet which some how exploded.

The planet Herschel was discovered with a five foot achromatick telescope, on the 13th March, 1781, and though its distance is 1800 millions of miles, yet, if the distanee of the nearest fixed star is 36000000 millions, and the mid-distance 18000000 millions, there is 10000 thousand times the distanee of Herschel for 10000 planets equally distant, from Herschel to the Sun.

The Satellites revolve as under:

	♃			♄			♅		
	d.	*h.*	*m.*	*d.*	*h.*	*m.*	*d.*	*h.*	*m.*
First . .	1	18	28	0	22	37	5	21	25
Seeond	3	13	14	1	8	53	8	17	1
Third . .	7	3	43	1	21	18	10	23	4
Fourth	16	16	32	2	17	45	13	11	5
Fifth . .	.....			4	12	25	38	1	49
Sixth .	.....			15	22	41	107	16	40
Seventh	.....			79	7	54			

The satellites of Herschel revolve perpendieular to our eeliptiek, and of course neither direct nor retrograde.

No fact yet verifies the Chaldean theory that the eomets have regular orbits; one or two have been surmised as identieal, but it is doubtful; one is said to have a period of 76 years, and therefore ought to appear in 1834, but there are few years without them; 5½ years is ascribed to another, 6.7 to a third—but mere guess.

100 eomets have entered the solar system with declination from 80° to 90°, 88 from 70 to 80; 79 from 60 to 70; 63 from 50 to 60; 84 from 40 to 50, and only 90 below 40°. Only 24 have passed between Mercury and the sun, 47 within Venus, and 58 between Venus and the earth's orbit, and 73 between the Earth and Mars. The rest between Mars and Jupiter's orbits. Their orbits seem to be defleeted or bent when they arrive at the *plane* of the zodiack. Astronomers are beginning to suspeet from their motions, that there is a resisting medium in space; a fact not to be doubted.

Comets are chiefly remarkable for a luminous projection in a line directly opposite to the sun, which therefore follows them as they approach the sun, and goes before them as they leave the sun, and is a head or tail as their positions vary; by the vulgar this luminous projection is always called a tail. Comets have very large atmospheres, and Herschel thinks some of them are all atmosphere; of course then the sun's

rays pass through the spherical atmosphere, just like light through a glass globe, and the projection increases in length as it approaches the luminous sun. This simple cause and effect did not however accord with one of Newton's hypotheses—that which asserted a vacuum in space, and therefore various irrelevant theories have been imagined. When a comet has a distinct nucleus the projection is divided in the middle by a sensible line, as that of 1811; these projections are some millions of miles long, and some even 80 or 150 millions.

The comet of 1811 was 10900 miles in diameter, i. e. twice the bulk of the earth, and its luminous projection was 132 millions of miles.

Schroeter.

But Lambert calculated that the comet of 1811 was 17 times larger than Jupiter, or 25100 times larger than the earth.

The comet of 1680, the largest in modern times, had its orbit inclined 61° 22′ 55″, and passed within half a million of miles of the sun's surface with a direct motion.

The comet of 1770 passed within two millions of miles of the earth.

The nebulæ or cluster of stars, called the milky way by the ancients, appears as a permanent luminous cloud; and as our sun and system are in the midst of it, the circle goes round the heavens. The larger visible stars, unless other remote nebulæ, are all part of the cluster. It is most luminous or thickest in the constellation of the Ship near the Great Dog. In Ophiuchus it divides, but reunites. It is supposed to contain millions of stars, and perhaps each 30 or 40 millions of millions of miles asunder. In such an arrangement only 17 would be nearest and largest, and it is so, for there are so many of the first magnitude.

Hipparchus, in 128 B. C., made a catalogue of 1022 stars, all that can be seen with the naked eye. Flamstead, with telescopes, made another of 2884. Bode, in 1800, of 27000; and Lalande, same year, of 50000. Herschel computed 50000 in nearly six degrees of the milky way.

If at the stars the earth's orbit is 1″, the distance is 40 billions of miles. Observations prove that it is not 2″, and the distance is taken at 36 billions. Herschel considered the milky way to be a nebulæ or cluster of stars, in nearly the middle of which is our sun, all the separate visible stars being part of it. He counted 2500 similar nebulæ or clusters in the heavens.

Space seems to be occupied with clusters of stars, serving as separate suns to planets and systems. The clusters are of all forms. That of the milky way is like a tuning fork, and all the visible single stars belong to it, besides the myriads of the milky way.

The distance of the remotest fixed stars supposed to be the nebulous clusters, may be best conceived by Herschel's idea that the light has been 48000 years progressing to us at its velocity of a million of miles in five seconds.

There are 34 northern constellations, 28 of which are ancient; and 45 southern, 14 of which were ancient. The British catalogue contains 17 stars of the first magnitude, 79 of the second, 223 of the third, and 510 of the fourth magnitude, being those commonly discerned by the naked eye. It gives 695 of the fifth magnitude, and 1604 of the sixth magnitude; in all 3128. The stars of the first magnitude are—

Aldebaran	in Taurus.
Castor	in Gemini.
Regulus	in the Lion.
Spica	in Virgo.
Antares	in Scorpio.
Dubhee	in the Great Bear.
Capella	in Auriga.
Arcturus	in Bootes.
Vega	in Lyra.
Deneb	in Cygnus.
Achernar	in Eridanus.
Betelgeuse	in Orion.
Canopus	in Argo.
Syrius	in the Great Dog.
Procyon	in the Little Dog.
Cor Hydræ	in Hydra.
Fomelhaut	in the Sou'n Fish.

The twelve signs of the zodiack, and the number of stars recorded in them in the tables, are as under—

♈ Aries	67
♉ Taurus	143
♊ Gemini	87
♋ Cancer	87

♌	Leo	101
♍	Virgo	117
♎	Libra	53
♏	Scorpio	37
♐	Sagittarius	73
♑	Capricornus	54
♒	Aquarius	119
♓	Pisces	115

The Greeks and Arabians borrowed the Zodiack from the Hindoos, to whom, according to Sir W. Jones, it has been known from time immemorial.

There are 28 stars which change their colours.

Algol varies its brightness from a second to fourth magnitude every 2d. 20h. 49′.

Areturus has a southern motion of 3′ 53″ in a century.

If the latitude is dedueted from 90°, the difference is the circle of stars at each opposite pole, which never rise or set in that latitude.

The Arabian astronomers under the Caliphs in 995, had a quadrant of 21 feet 8 inches radius, and a sextant 57 feet 9 inches radius.

Kepler promulgated three laws of planetary motion: 1. That the squares of the times are as the cubes of the distances. 2. That a planet moves through equal areas in equal times; and, 3. That the planets deseribe elliptical orbits with the sun in one of the foci.

Rising, Southing, and Setting of the Pleiades, for every 5th Day in the Year, to determine the Hour of the Night, in the Latitude of England.

Months.	Days.	Rise.	South.	Sets.
		h. m.	h. m.	h. m.
January.	1	0A 28	8A 45	5M 2
	6	0 06	8 23	4 40
	12	11M 39	7 56	4 13
	17	11 17	7 34	3 51
	22	10 56	7 13	3 30
	27	10 35	6 52	3 9
February.	1	10 15	6 32	2 49
	6	9 55	6 12	2 29
	12	9 31	5 48	2 5
	17	9 12	5 29	1 46
	22	8 52	5 9	1 26
	27	8 34	4 51	1 8
March.	4	8 15	4 32	12A 49
	9	7 56	4 15	12 30
	12	7 45	4 2	12 19
	17	7 27	3 54	12 1
	22	7 7	3 24	11 41
	27	6 49	3 6	11 23
April.	1	6 31	2 48	11 5
	6	6 13	2 30	10 47
	12	5 51	2 8	10 26
	17	5 33	1 50	10 7
	22	5 14	1 31	9 48
	27	4 55	1 12	9 29
May.	2	4 37	0 54	9 11
	7	4 17	0 34	8 51
	12	3 58	0 15	8 32
	17	3 38	11M 55	8 12
	22	3 18	11 35	7 52
	27	2 58	11 15	7 32
June.	1	2 38	10 55	7 12
	6	2 18	10 35	6 52
	12	1 54	10 11	6 28
	17	1 32	9 49	6 6
	22	1 12	9 29	5 46
	27	0 51	9 8	5 25
July.	2	0M 30	8M 47	5A 4
	7	0 10	8 27	4 44
	12	11A 49	8 6	4 23
	17	11 29	7 46	4 3
	22	11 9	7 26	3 43
	27	10 49	7 6	3 23
August.	1	10 30	6 47	3 4
	6	10 10	6 27	2 44
	12	9 48	6 5	2 21
	17	9 29	5 46	2 2
	22	9 10	5 27	1 44
	27	8 52	5 9	1 26
September.	1	8 34	4 51	1 8
	6	8 16	4 33	0 50
	12	7 54	4 11	0 28
	17	7 36	3 53	0 10
	22	7 18	3 39	11M 52
	27	6 58	3 16	11 33
October.	2	6 40	2 57	11 14
	7	6 22	2 39	10 56
	12	6 4	2 21	10 31
	17	5 44	2 2	10 19
	22	5 26	1 43	10 0
	27	5 7	1 24	9 48
November.	1	4 48	1 5	9 22
	6	4 28	0 45	9 2
	12	4 4	0 21	8 58
	17	3 43	0A 0	8 17
	22	3 23	11 40	7 57
	27	3 1	11 18	7 35
December.	2	2 40	10 57	7 14
	7	2 18	10 39	6 52
	12	1 56	10 13	6 30
	17	1 34	9 51	6 8
	22	1 12	9 24	5 46
	27	0 50	9 7	5 22

One tide lengthens the earth's radius on one side, and then the equal force of rotation demands that the opposite radius be lengthened also, and hence opposed tides.

The square root of the earth's orbit motion, $\sqrt{98163} = 323$ is a mean proportional between the rotation and the fall of a body. The moon's orbit motion is a mean proportional of the earth's bulk by the earth's orbit motion. The orbits of the planets are a mean proportional of the sun's bulk by the sun's progressive velocity.

A body after falling 189 seconds, acquires a velocity of 6100 feet per second, equal to the whole centripetal force of the earth's surface.

The chord of the arc of a quadrant is the square root of two or 1.41415, hence every radius by 1.41415 is the chord; or by 1.5708 is the arc of the quadrant.

The earth's diameter is repeated about 74000 times in the orbit, which is of an egg-form.

Increase and Decrease of Days for every Fourth Day in Latitude of 52°.

Days.	January.	February.	March.	April.	May.	June.
	Increase.	*Increase.*	*Increase.*	*Increase.*	*Increase.*	*Increase.*
	h. *m.*	*h.* *m.*	*h.* *m.*	*h.* *m.*	*h.* *m.*	*h.* *m.*
1	0 8	1 26	3 12	5 14	7 6	8 32
5	0 14	1 38	3 26	5 30	7 20	8 38
9	0 20	1 54	3 42	5 44	7 34	8 44
13	0 28	2 8	3 58	6 0	7 46	8 48
17	0 38	2 24	4 14	6 16	7 56	8 50
21	0 50	2 40	4 30	6 30	8 8	8 52
25	1 2	2 54	4 46	6 44	8 18	
29	1 16	.....	5 2	6 58	8 26	
31	.....	.....	5 10	.....	8 30	

Days.	July.	August.	September	October.	November	December
	Decrease.	*Decrease.*	*Decrease.*	*Decrease.*	*Decrease.*	*Decrease.*
	h. *m.*	*h.* *m.*	*h.* *m.*	*h.* *m.*	*h.* *m.*	*h.* *m.*
1	0 6	1 14	3 2	5 0	6 58	8 30
5	0 10	1 26	3 18	5 16	7 12	8 36
9	0 16	1 38	3 34	5 30	7 26	8 44
13	0 24	1 52	3 48	5 46	7 40	8 48
17	0 32	2 6	4 4	6 2	7 52	8 50
21	0 42	2 22	4 20	6 18	8 4	8 52
25	0 52	2 36	4 36	6 34	8 16	Iner. 2
29	1 4	2 50	4 52	6 48	8 26	

As every body which goes round in an orbit turns from that cause once on its axis, so the earth turns an extra time before it returns to the same star, and exactly by this quantity at the equator, the stars go back by a motion of 22700 miles, called the precession with reference to the seasons, in 25868 years. The moon's nodes fall back also by a quantity exactly equal to its circumference 6730 miles in 19 years. The line of Apsides advances 50617 per annum, or 360 deg. in 20931 years, owing to the earth passing quicker from the perihelion to the aphelion than the contrary.

The solstitial points are the first degrees of Cancer and Capricorn; and the equinoxial points are the first degrees of Aries and Libra.

At 5 feet high the dip of the horizon is 2′ 8″; at 10 feet 3′ 1″; at 20 feet 4′ 16″; at 30 feet 5′ 14″; at 50 feet 6′ 44″; and at 100 feet 9′ 33″.

Right-Ascensions in Time, and Declinations and Magnitudes of Forty remarkable Fixed Stars, with their Names.

Names of the Stars.	Rt. Asc.	Declination.	Mag.
	h. m. s.	° ′ ″	
Polestar, Almuccabah	0 52 20	88 14 25 n	2
Andro gird. Mirach	0 58 34	34 33 29 n	2
Andro. foot, Almach	1 51 41	41 21 50 n	2
Ram's follow-horn	1 55 55	22 30 47 n	2
Whale's ja. Menkar	2 51 50	3 18 8 n	2
Medusa's hea. Algol	2 55 12	40 10 29 n	2
Perseus' si. Algenib	3 10 7	49 8 15 n	2
Brightest of the 7st.	3 35 37	23 28 36 n	3
Bull's eye, Aldebar	4 24 27	16 5 43 n	1
Auriga's sh. Capella	5 1 56	45 46 40 n	1
Orion's l. foot, Rigel	5 4 56	8 26 24 s	1
Bull's north horn	5 13 40	28 25 37 n	2
Orion's l. sh. Bellat.	9 14 54	6 9 21 n	2
Orion's girdle	5 26 4	1 20 27 s	2
Orion's r. sh. Betelg.	5 44 21	7 21 41 n	1
Great Dog, Sirius	6 36 20	16 27 2 s	1
1st Twin, Castor	7 21 49	32 18 59 n	1
Little Dog, Procyon	7 28 49	5 43 45 n	1
2d Twin, Pollux	7 33 3	28 29 59 n	2
Hydra's heart, alp.	9 17 45	7 46 46 s	2
Lyon's heart, Regu.	9 57 42	12 56 29 n	1
Great Bear, L. Pointer	10 49 40	57 27 3 n	2
Great Bear, U. Pointer	10 51 16	62 49 45 n	2
Lion's tail, Deneb	11 38 50	15 41 36 n	2
Great Bear's tail, Aliath	12 45 13	57 2 57 n	2
Virgius' spike	13 14 40	10 6 37 s	1
Dragon's tail	13 58 59	65 20 8 n	2
Bootes, Arcturus	14 6 32	20 13 43 n	1
Libra, South. Scale	14 39 39	15 11 54 s	2
Libra, North. Scale	15 6 16	8 38 3 s	2
North Crown	15 25 58	27 23 58 n	2
Scor. heart, Antares	16 17 10	25 58 21 s	1
Her head, R. Alget.	17 5 32	14 37 48 n	2
Head of Serpentarius	17 25 39	12 43 9 n	2
Drag. head, Rastaben	17 51 58	51 31 5 n	2
The Harp, Lyra	18 30 10	38 36 26 n	1
The Eagle, Atair	19 41 1	8 21 11 n	2
S. Fish, Fomalhaut	22 46 34	30 40 31 s	1
Pegasus' w. Markab	22 54 48	14 7 56 n	2
Andromeda's head	23 58 4	27 59 34 n	2

As large masses of matter are probably alike, so the density of the planets would be equal.

The perihelion point moves through a sign in $\frac{20940}{12}$=1745 years, hence it is 5235 years in passing from the equator to the tropicks, and vice versa. It is now in 9 deg. of Capricorn, and was in that southern tropick 500 years since; thence it last passed the equator 5735 years since, and will return to it in 4235 years.

The rotation of the earth and any planet is caused by the very same force, acting on its superiour hemisphere, as carries it from the chord or diagonal into the curved orbit. This angle is 5° 41′, and the sine 993 for radius 10000, i. e. 1 to 10.06, which reduced by the sine of the obliquity, or 1 to 5, gives 8.04 for that hemisphere, and 16.08 for both. Then

$\frac{98163}{16.08}$ = 6100 the actual force per second.

The earth's rotation would not equal its orbit motion till 64000 miles from the centre, hence the air may have weight to that distance.

The length of the day in latitude 49, 51, 53, and 55 for the above declinations is as under:

	hrs.'	*h.* '	*h.* '
Lat. 49	12.54	14.45	15.53
51	12.56	14.58	16. 6
53	13. 3	15.10	16.40
54	13. 8	15.27	17. 4

The earth's axis is inclined 23 deg. 27′ 56″, and decreases 52″ in a century.

In eclipses the word digit means one-twelfth part of the diameter of the sun and moon.

The obliquity of the ecliptick varies above half a second per annum, or from 50 to 60 seconds in a century. Hipparchus fixed it at 23° 51′ 20″, and it is now 23° 27′ 30″, making a difference of 23′ 50″ in nearly 2000 years. The cause is the unequal distribution of land and water on the globe, and as the inequality diminishes by the washing of rains, so the parallelism of the diurnal and annual motions continually approaches.

The experiments at Shehallien, &c. which determined the mean density of the earth 4½ times that of water, are founded on the assumption that inert bodies attract one another, but as a body inclines to a mountain, on the very same principle that corks float towards bungs, their intercepted atmospherick pressure, the data are inferred to be fallacious.

The zodiacal light is ascribed to the solar atmosphere, and to its condensation in the plane of the zodiack.

The angle of 23° 27′ made by the ecliptick with the equator determines all the zones and circles on the Globe. Thus, the tropicks are 23° 27′ on each side the equator; and the polar arctick and antartick circles are 23° 27′ from the north and south poles. The middle regions 90 —46 54, or 43° 6′ are the temperate zones.

The casting of a nativity among astrologers means the drawing out a picture of the heavens at the minute of birth, in which the signs are disposed in 12 equal spaces, called houses, and the planets, &c. put into the signs. On this judgement is given, but as there is no possible or probable connexion between these signs and the subject, so a pack of cards, or any other combination, would answer the same purpose.

As the motion of a falling body will not exceed the force which produces the fall, or 6100 feet per second, so in 189″ the velocity would become uniform at 6100 feet per second. The velocity arising from continuous force is as the square of the times of falling; the first second 16.08 feet nearly, or 16.085 in latitude 51.32, so that in 4 seconds the velocity is 4×4×16.085—and so on.

The fall of a body is as the ratio of the velocity in the orbit per second, 98163 feet, to the velocity of the rotatory surface of the earth, which surface is 4 times the area of the equatorial circle, which moves 1525.6 feet per second.

Then $\frac{98163}{1525.6\times4}$ = 16.085 feet, the mean fall per second all over the earth.

The nonagesimal degree is the 90th of the ecliptick from the horizon.

The solar tide, explained by Galileo, is to that of the moon only as about 1 to 5.

The time of high-water being known at London, it may be known at the following places by *adding*,

	h.	*m*
For Tinmouth Haven, Hartlepool, and Amsterdam	0	30
Brest	1	0
Scilly	1	45
Mount's Bay	1	55
Bridlington Pier and Humber	2	0
Fowey, Loo, and Plymouth	3	10
Dartmouth, Scarborough, and Hull	3	30
Torbay and Tinmouth	3	40
Exmouth, Topsham, and Lime	3	50
Bristol and Weymouth	4	20
Bridgewater and Texel	4	40
Portland and Hartfleur	5	50

By *substracting*,

For Leigh, Maes, and Gouries Gut	0	5

Gravesend, Rochester, and Rammekins	1 20
Buoy of Nore and Flushing	1 30
Portsmouth, Ostend, Shoe-Beacon, and Red-Sand	2 0
Harwich, Dover, Spithead, and Calais	3 0
Gunfleet, Hastings, Shoreham, Orfordness, and Dieppe	4 0
Yarmouth Pier & Needle	4 40
St. Helen's and Havre-de-Grace	5 30

The diameters of the bodies in the solar system are, the Sun, 883246 miles; Mercury, 3224; Venus, 7687; the Earth, 7916; Moon, 2209; Mars, 4139; Ceres and Pallas uncertain; Juno, 1425; Vesta, 238; Jupiter, 89170; Saturn, 79042; Herschel, 35112.

Their distance by Kepler's law, $D^3 : d^3 :: P^2 : p^2$ are Mercury, 37; Venus, 68; Earth, 95; Mars, 144; Ceres, 263; Pallas, 266; Juno, 252; Vesta, 225; Jupiter, 490; Saturn, 900; Herschel, 1800 millions.

The distances by the Editor's new law, $D : d :: T^{\frac{2}{3}} : t^{\frac{2}{3}}$, founded on the law of force, $D^{\frac{1}{3}}$; or, $1.83 \times t^{\frac{2}{3}} = d$. Mercury, 36.2; Venus, 67.7; Earth, 93.5; Mars, 143; Jupiter, 480; Saturn, 890; and Herschel, 1800 millions.

The inclinations of their orbits to the plane of the ecliptick is:

	°	′	″
Mercury	7	0	0
Venus	3	23	35
Moon	5	9	3
Mars	1	51	0
Ceres	10	37	0
Pallas	34	50	40
Juno uncertain.			
Vesta	7	8	46
Jupiter	1	18	56
Saturn	2	29	50
Herschel	0	46	20
Inclination of Sun's axis,	82	44	0
Moon's	88	17	0
Mars'	59	22	0

Periods:	*years.*	*days.*	*h.*	*m.*	*s.*
Mercury	0	87	23	15	43
Venus	0	224	16	49	10
Earth	0	365	6	9	12
Mars	1	321	23	15	44
Vesta	3	240	4	55	1
Juno	4	130	23	57	7
Ceres	4	221	13	56	9
Pallas	4	221	17	0	5
Jupiter	11	315	14	27	11
Saturn	29	174	1	51	11
Herschel	83	150	18	0	0

Rotation on axis:	*days.*	*h.*	*m.*	*s.*
Sun	25	14	8	0
Mercury	0	24	5	0
Venus	0	23	29	59
Earth	0	23	56	4
Mars	0	24	39	22
Jupiter	0	9	56	0
Saturn	0	10	16	2

Eccentricity, half the major axis being 1: Mercury, .2055; Venus, .00695; Earth, .01685; Mars, .09313; Vesta, .093322; Juno, .2549; Ceres, .07835; Pallas, .24538; Jupiter, .048178; Saturn, .056108; Hersehel .04667.

The line of Apsides, or the aphelion and perihelion, advances 61.45″ per annum, chiefly owing to the earth moving quicker from the perihelion to the aphelion than the contrary.

Twilight lasts till the sun is 18 degrees below the horizon, when the solar rays are reflected from a height of 44 miles. The horizontal refraction is 30′ 51″ nearly the diameter of the sun, so that the sun has set when his body touches the horizon to the eye.

Great equation of centre:

	°	′	″
Mercury	28	40	0
Venus	47	20	0
Earth	1	55	30.9
Mars	10	40	40
Pallas	28	25	0
Jupiter	5	30	38
Saturn	6	26	42
Herschel	5	27	16

The apparent diameter at the Earth of Pallas, is half a second; of Juno, 3″; and of Vesta half a second; Ceres varies from 1″ to 6″; Herschel is 3½″; Mercury, 10″; Saturn, 18″; Mars, 27″; Jupiter, 39″; and Venus, 58″.

The line of Apsides in 100 years moves.

	°	′	″
In Mercury	1	33	45
In Venus	1	21	0
Earth	1	43	10.8
Mars	1	51	40
Jupiter	1	34	33
Saturn	1	50	7
Herschel	1	29	2

The perihelion of the Earth at 1° 43′ 10″.8. in a century, or 61.8″ per annum, makes a revolution in 20931 years; and the equinoxes recede 50.1″ per annum, or 1° 23′ 30″ in a century, and make a revolution in 25868 years. Hence, on January 1, 1830, the perihelion was 9° 11′ 6″ of Capricorn;—i. e. on the 30th of December the sun is 3 millions of miles nearer than on the 30th of June.

The earth's perihelion distance, the mean being 1, is 9831468; and it is in this point when the sun is in 9° 11′ 6″ of Capricorn—i. e. on December the 30th 1830. Adding 61.6-8″ per annum from January 1, 1830. It is given thus particularly, because its varying declination is believed to be the causes of the progression of the seas from one hemisphere to another. It crossed the solstice of ♈ in 1295, and the equator 3938, B. C., causing the flood of Moses; and it will cross it again in the year 6528, or in about 4700 years.

ATMOSPHERICAL AND ÆRIAL PHENOMENA.

The size of the volume of the gaseous atmosphere, which accompanies the earth in its orbit, and rotates with it, is an unsolved problem. The twilight proves that it contains vapours dense enough to reflect light as high as 44 or 45 miles. The rarefaction by solar heat, and the rotation, are supposed to render it an oblate spheroid. But as it would have central force till the two motions were equal; so, as at the surface of the earth, at 3958 miles from the centre, it revolves with a total momentum of only 6101, while the orbit motion is 980; then $\frac{98000}{6101} \times 3958 =$ the height which it may rotate, or nearly 64000 miles from the centre, if the peculiarities of elasticity, &c. do not alter this result.

Its height, as a uniform gas, of the same density as at the earth's surface, proved by its pressure of 2158 lbs. to the square foot, would be but 5.6 miles; for a cubick foot weighs but $1\frac{1}{5}$ oz. which gives 29500 feet in 2158 lbs. But the earth's reaction, and its compression into a narrowing space, and its own elasticity, afford a dilatation as it ascends, in the geometrical ratio of the altitude. Of course, however, this must have *a limit*, and tables which run up the expanding series are fanciful. These show, if we believed them, that a cubick inch of air, at 500 miles high, would fill a sphere 1800 millions of miles in diameter; that at 7 miles it is equal to 4 inches; at 14 miles, 16 inches; at 28 miles, 256; at 42 miles, 4096; and at 49 miles, 16384. But probably, no gas is rarer, or much rarer, than hydrogen, or about thirteen times the rarity of common air.

Altitudes are determined by the law, that the densities (within known limits) decrease in geometrical progression as the altitudes increase in arithmetical progression, the two forming a series of atmospherick logarithms.

[The superficial extent of the atmosphere at its lower surface, is equal to about 200,000,000 of square miles. We have before seen that its altitude, if reckoned at the uniform density of its lower surface, or in other words, according to its actual quantity, is equal to five miles and six-tenths only. Considered, therefore, as a fluid stratum resting upon the earth, the horizontal or superficial extent of the atmosphere is to its altitude or vertical dimensions as 35,714,285 to 1; a fact that well deserves consideration in any physical estimate of its winds and currents.]* See page 178–9; see also *Air*, in Chymistry.

Elevation above the level of the sea, or the general level of a country, makes a regular variation in temperature; the first 300 feet makes a difference of a degree, almost as truly as though the height were measured. This arises from the diminution of reflected heat from surrounding objects. After ascending 300 feet, the thermometer falls a degree at 295 feet, then at 277, 252, 223, and 192 feet; so that at 1539 feet of elevation, the thermometer will fall six degrees in a general way, but 300 feet per degree is the common rule. On these principles, the limit of perpetual congelation has been theoretically calculated: it is made 15000 feet at the equator; and from that to 13000 be

* The matter included in brackets is supplied by the American Editor.

tween the tropicks; and from 9 to 4000 between lat. 40 and 59 deg.

[It has been found, however, that the above rule is subject to great variations, owing probably to the physical character and temperature of the atmospherick currents which prevail in different regions and at different altitudes. Warmer strata or currents are often found resting upon, or interposed between, those of a lower temperature. On the Himalaya mountains between the latitudes of 28° and 34° north, the region of vegetation has been found to extend many thousand feet above the supposed line of perpetual congelation assigned to those latitudes. It is also remarkable that the line of perpetual snow is found at a much greater altitude on the *northern* side of these mountains than on the southern side in a lower latitude. These facts, with others which are obtaining notice, will cause a revision of the hitherto prevailing theories in meteorology.]

The cold and heat of climates depend also on the vicinage of seas.—At Moscow, the thermometer ranges from 6 to 70, but at Copenhagen, in the same latitude, only from 27 to 65; so, at Vienna, it ranges from 26 to 70, but on the French coast, in the same latitude, only from 41 to 67.

The medium annual temperature of the whole earth is 50 degrees.

At the equator on the level of the sea, the mean annual heat is 84.2 degrees; at lat. 45, 58 degrees; in lat. 50, it is 53.6; in lat. 60, 45 degrees; and in lat. 70, 33.1 deg. The vicinity of the Poles, is assumed to be the freezing point 32 degrees. Between the tropicks, the variation from latitude is but 8 degrees; lat. 23° 8′ being 76; in lat. 45, the average heat in summer to that in winter, is as 120 to 42, and the Arctick circle as 102 to 12.

In the Gulf of Guinea the thermometer rises to 130°; and Humboldt thinks that in the air it can never rise above 140; at sea it never rises above 85 or 83.

The thermometer in Italy ranges between 75 and 96°; and in winter, seldom descends below 40°, except in the mountains in the higher Appennines, where it falls to 20 deg.

The climate of the southern hemisphere is milder than the north. In May, at Cape Horn, lat. 56, our November vegetation is flourishing.

The thermometer is usually highest at two o'clock in the afternoon, and lowest before sun-rise.

The average temperature of the winter months in England is about 40°, and of the summer months 65°. Devonshire and Cornwall are about 4 deg. warmer than London.

In the past century the severe frosts in England were in the winters of 1708, 1715, 1739, called the hard frost, 1742, 1754, 1776, 1788, 1796, and 1813.

In the counties round London the mean temperature and rain, in every month, are as under:—

January	deg. 36.1	inches	1.483
February	38	....	.746
March	43.9	....	1.44
April	49.9	....	1.786
May	54	....	1.853
June	58.7	....	1.83
July	61	....	2.516
August	61.6	...	1.453
September	57.8	...	2.193
October	48.9	...	2.073
November	42.9	...	2.4
December	39.3	...	2.426
	48.5		22.199

The most intense cold ever known in London was on December 25, 1796. The thermometer was at 2° below zero.

The 14th of January, on an average of years, is the coldest day in the year.

The annual average of the thermometer at the north and south points of England, Carlisle, and Sandwich, is 48 and 50°; the maximum, in 1820, being 78 and 83, and the minimum 12 and 27. London is the same as Sandwich.

At Kinfaun's Castle, N. B. lat. 56° 23′ the mean temperature for 1830 was 47.626. The rain 30.85 inches. Coldest day 10°, and hottest 79°. Barometer from 30.53 to 28.73.

The average heat of London in the first sixteen years of this century, was 50.93°. The hottest day, from 1774 to 1817, was in July, 1808, being 93.5, and the coldest, Dec. 25, 1796.

At London in 1830, the highest point of the thermometer was 90 in June, and the lowest 11 in January. The wettest month was 2.516 in July, and the driest 0.746 in February.

In New South Wales the coldest month averages 54°, and the hottest 75°. It rains 100 days in the year. The north-west wind is a scorching sirocco. The air is generally dry, but the night dews are heavy.

The mean temperature of Ireland varies from 47° to 53°.

The average heat of Boston is 47° 3′, of Philadelphia 53° 7′, of Washington 58.1, of Detroit 47.4, of Cincinnati 56.8, of Pittsburg 54.2, of New Harmony 56.69, Rain 42.85, Charleston 57 to 60, Richmond 56.1.

At Leeds, Yorkshire, the thermometer was, July 18, 1825, at 92; June 25, 1826, at 93; and Jan. 2, 1827, at 11 degrees.

An iceberg seen by Parry was above 250 feet out of the water, and therefore nearly one-third of a mile thick.

[In the months of March, April, May, and June, ice is often met with in the Atlantick ocean near the banks of Newfoundland, and sometimes as low as the 40th degree of latitude. It is brought down from the higher latitudes by the great northern or polar current, which in consequence of its greater density passes under the warmer current of the gulf-stream, and continuing its action upon the deeper portions of the great icebergs often forces them into the bosom of that stream, where they soon become dissolved.]

Temperature is so variable in South Carolina that the thermometer sometimes varies 50 degrees in 24 hours; it ranges no less than 83 degrees in the year. The rain averages fifty inches.

Clouds and Fogs are the same thing. We see the whole as a cloud at a distance in the atmosphere, but when the vapour sinks to the earth or will not rise, and we are immersed in it, we call it a fog. Dew fogs which hang over fields are *stratus* clouds; and fogs which involve elevated objects are *cumulus* clouds. [It is to circumstances of distribution, light, shade, and perspective, that the great variety in the *appearance* of the clouds is owing, and on this variety of appearance their imperfect classification has been founded.]

There are seven classes of clouds:

1. Like a lock of hair, or a feather, called *Cirrus*.

2. A cloud in conical round heaps, called *Cumulus*.

3. A level sheet, called *Stratus*.

4. A system of small round clouds, *Cirro-cumulus*.

5. The concave or undulated stratus, called *Cirro-stratus*.

6. The cumulus and cirro-stratus mixed, called *Cumulo-stratus*.

7. A cumulus, spreading out in cirrus and raining beneath, called *Nimbus*.

The cirrus is the most elevated—sometimes as a gauze veil—or parallel threads. Its height is from three to five miles.

Fleecy clouds are seen over head, on the tops of the highest Andes, and on looking over the sea, a stratum of mist is visible at the height of 10 or 11000 feet. Here, however, the sky is clearest, but it loses part of its clearness in passing from the high lands in the Torrid Zone, north or south.

[Dew is the condensation of watery vapour upon the surface of a condensing body or substance. Clouds and fogs are watery particles which are condensed while floating in the atmosphere, where they continue to float till precipitated, or again dissolved. If by the concentration of these particles, or by additional condensation, their weight be increased beyond that which the extent of their surface can sustain, they then descend in the form of rain. The formation of clouds and fogs, dews and rain, is therefore essentially the same, the latter being but the continuation or extension of the same process which produced the former.]

Evaporation is as the surface of water and as the temperature.

In the temperate zone the annual evaporation is 37 inches, but in the tropicks from 90 to 100; and the mean quantity of rain is in the same proportion. At Bombay, in 10 years, 78 inches per annum fell; in 1822, 113

inches; and in 1824 but 34. In the Brazils, in 1821, 280 inches fell; and in Cayenne, 160 inches in February only. At Cumana it is but 8 inches in the year. But in Peru none.

The atmosphere of Greece is so dry that at 86° F. nearly the whole of the animals and vegetables disappear.

The changes of the moon have no connexion with the weather.

The rainy season between the tropicks is when the sun is in vertical signs; and at other times there is not a cloud for months. North the rainy months are from April to October; and south, from October to April.

Rain, within the tropicks, is not of the drizzling character of rain in the temperate zone, but generally falls in such torrents as, in other zones, would be called waterspouts; and they produce greater floods in a single day than in Europe in six days. Winter is distinguished from summer chiefly by the quantity of rain, which, for six months, is often constant for many days together, and lasts a certain number of hours per day through the whole six months. The rivers, in consequence, overflow; and, in many countries, produce general inundations in all the low lands, which intercept communication, and, on drying off, make the atmosphere very unwholesome. Of course, such heavy and constant rains must tend to diminish the heights of the mountains and create embankments in the sea, as germs of future land.

The bulk and specifick gravity of rain water is taken, at 60 deg., as 1. Less heat diminishes its bulk and increases its specifick gravity. At 40°, one is .9907, and specifick gravity 1.00094. But at 80°, the bulk is 1.00242, and the specifick gravity .99759; and at 100°, is 1.006 and .99402.

Humboldt assigns 96 inches of annual rain to the equatorial zone, 80 to lat. 20, 29 to lat. 45, and 17 to lat. 60, as a general average.

From three to four times as much rain falls in a year between the tropicks as in higher latitudes; yet the number of days on which it rains generally increases as the latitude.

The average fall of rain for the United Kingdom is about 34 inches, but in the western and hilly counties is 48 or 50 inches.

The average rain in London for 40 years, between 1777 and 1817, was 20.686 inches. At Paris, in 15 years, 18.649. At Glasgow, in 17, was 21.033; and at Manchester, in 33, was 36.104. At Kendal, 1830, 58.03.

In 1800, the quantity of rain at Cambridge was 25.62; Lynden, Rutlandshire, 32.35; West Riding 26.9; Lincoln 24.11; Chatsworth 26.73; Lancaster 35.93; Kendal 48.2; Exeter 24.5; Plymouth 35.5.

The rain at Dublin is about 26 inches, and at Cork 36.

On the 9th of October, 1827, there fell at Joyeuse, in France, 29 inches of rain in 22 hours; and in 11 days 36 inches, double that at Paris in the year.

The mean quantity of water held in a cubick foot of air, in this climate, is 3.780 grains.

[The quantity of rain falling at a given point is found (in the higher latitudes) to depend greatly on the proximity of that point to the surface of the earth, without regard to the altitude above the level of the sea: the rain guage on the top of a mountain giving nearly as much as that on the plain beneath, whereas one guage placed on the top of a house or church, and another below, give very different quantities. It appears from very accurate observations, that in one year there fell below the top of a house above a fifth part more rain than fell in the same space above the top of the same house;—and that there fell upon Westminster Abbey not much above half the quantity that was found to fall in the same space at the earth's surface. The following observations may be adduced.

Lower guage (in one year) 22.608 inches. Middle guage, top of a house 18.139 inches. Upper guage on Westminster Abbey, 12.099.

The experiment has been repeated in other places with the same result.]

Hail stones fall with a velocity of 60 or 70 feet per second. Rain from 10 to 30 feet. From 3 to 400 tuns of

rain fall annually on every aere in England.

Crystals of snow are from one-third to one-thirty-fifth of an ineh in diameter. Their figures are diversified stars.

The red eolour of some snow is aseribed to a fungus which grows on the snow.

The chymical difference between rain and snow water was determined by Margraaf to be very slight.

The Aurora Borealis, though seldom seen in middle Europe, is almost constant in the Aretick and Antarctick regions, covering the whole heavens and eclipsing, by its splendour, the stars and planets. It is accompanied by a rustling, snapping noise, and taken altogether, is often terrifick. Some ascribe these phenomena to fluids, as electrick or magnetick, of which they presume the existence.

The height of the Aurora Borealis in the Aretiek regions is only 6 or 7 miles. A confused sound accompanies it, and it affects the magnetick needle. At Melville Island it always appeared in the south, and Parry therefore called it the Aurora Australis.

Luminous bands at vast heights, are often seen stretching from west to the zenith and beyond, and about three or four degrees wide. What they are is unknown, but they probably derive their light from the sun after it has set to lower regions.

The ignis fatuus and such other luminous meteors are the combustion of phosphureted hydrogen, on its ascension into the air, from putrid and fermenting vegetation or soils. Luminous clouds and the aurora borealis are supposed to be of the same nature, the gases in Polar regions being evolved by freezing, and burning in contaet with hydrogen in the upper atmosphere.

The stones which fall from the atmosphere called aerolites, or aeroliths, are semi-metallick, and consist of—

Silica - - -	54
Oxyde of Iron - -	36
Magnesia - -	9
Oxyde of nickel - -	3
Sulphur - - -	2
Lime - - - -	1

Their speeifiek gravity is 3.4. Their origin is unknown; the different theories being very unsatisfactory. If they were projections from the moon, as some pretend, they would fall only in the tropieal regions.

The reeords of stones falling in all ages and countries, are at least 300 in number; and some reeent instances are perfectly well authenticated. They fall by the explosion of a mass which probably acquires increase of heat, as it approaches to the earth. The most probable theory respecting them is, that they are independent masses, floating in space, and encountered by the earth and atmosphere in the annual orbit. They fall in all latitudes, and, therefore, not from the moon; and their substanee has a crystalline character, regular and sudden, not volcaniek.

The meteorick stones which fell at d'Aigle, in France, in 1803, eontained as above.—One which fell in Yorkshire, consisted of 75 Siliea; 48 Oxyde of Iron, 37 Magnesia, 2 Oxyde of Nickel. Lists of 2 or 300 have been published by Chladni, King, and Howard, which have been recorded in different eountries.

Near Baku, in Persia; in some parts of Italy; and in an island in the Levant, there are natural orifiees in the earth, through which inflammable gas passes; sometimes it takes fire on coming into eontact with the atmosphere, and at other times requires to be lighted like a gas lamp: similar gas constantly issues from the veins of coal mines, and may be lighted and eonsumed in like manner.

At Baku, temples for fire worship are erected over them; and one of them, the priests or devotees allege, has been burning for several thousand years, and will continue as a miracle till the end of the world. They eall it the everlasting fire.

Hanway relates, that the flame makes the soil hot, without eonsuming it, and if made to pass through a cane or cone of paper, does not eonsume them, though the flame will boil a pot. The ground is dry and stony, and smells like sulphur, and if uncovered, the flame spreads to any distance. Brimstone is dug as an article of eommeree, and naphtha springs arise, frequently in jets

2 or 3 feet high, which on drying, become black, like pitch. In Persia, they burn it in their lamps, and for cooking; and in Russia they use it as a medicine. Springs of hot water likewise arise near Baku.

The same sort of combustible exhalations arise in China, and that industrious people use them for purposes of manufactory.

Between 1666 and 1669, the village of Boncourt upon the Eure, containing 80 houses, was burnt at sundry times, by igniting exhalations like the *ignus fatuus*, of a blue colour and offensive smell. It was most frequent in August and September, and accompanied by clouds of a red colour.

[Wind is a sensible movement in the air over the earth's surface. It has been truly said that the theory of winds is one of the least perfect parts of natural philosophy. It is on facts alone that we must rely for more accurate knowledge.]

In the torrid zone, when mountains do not interfere, the winds follow the sun, and blow constantly in the open seas from east to west. This tract extends about 25 or 30° on each side the equator.

Below latitude 30°, there is a general tendency of the wind to blow from the east and south-east. There is often noticed an upper current blowing contrary to the trade winds. Westerly winds prevail from 30 to 60°. In hot climates near the sea shore, the wind sets from the sea to the land during the day, and the contrary by night. In the Polar regions the winds are more irregular than in lower latitudes. Winds increase in force with elevation.

The constant current of the trade winds produces other winds to the north and south, tending to maintain the general equilibrium; and near the coast they are varied by the diurnal changes of temperature which result from the proximity of land; and also by mountains.

In the Indian ocean the trade wind instead of blowing from east to west, takes opposite currents for six months, and at the times of change they produce tornados and storms by what are called the breaking up of the Monsoons, which is the name of the six months' wind. To the south of the equator, from 10 to 23°, the wind blows constantly from the east and south-east; but from 10° northward to the equator, north-west winds blow from October to April, and south-west from April to October; and north of the equator to the Tropick of Cancer south-west winds prevail from April to October, and north-east winds from October till April.*

[The north-west and south-west Monsoons, which have been erroneously ascribed to the effects of local or continental rarefaction, are sometimes found to extend themselves far to the eastward of the Asiatick continent and islands, and even to the central portions of the great Pacifick ocean.

The dry current of the north-east Monsoon on approaching the equator becomes deflected and checked in its course, and after crossing the equator returns again to the eastward, in the southern latitudes, in the form of the wet north-west Monsoon. On the other hand the dry south-east Monsoon which prevails in the opposite season south of the equator, becomes deflected in the equatorial region in the same manner, and returns to the eastward north of the equator in the character of the south-west Monsoon.

In Ceylon, (lat. 8° north) the north-east Monsoon, with a temperature of 68° Fahrenheit, has a dryness of 75 hygrometrick degrees. The opposite Monsoon, from the south-west at 82° Fahrenheit, is so damp as to indicate but 30 degrees.]

As the winds, over a breadth of 60 degrees, blow, with slight interruption, from east to west; so in the northern and southern hemispheres the atmospherick equilibrium demands that the prevailing winds should be from west to east, and therefore, for the most part, westerly winds prevail for two-thirds of the year, and they enable ships which sail to the West Indies by the trade winds to return to the East by

* The hypothesis of rarefaction, which in the English edition was interwoven with some of these paragraphs, has been omitted. The omission is at least in accordance with the late practice of the best European writers in this branch of natural philosophy.—Am. Editor.

first ascending to the latitude of 40 or 45°.

[The trade winds, in both hemispheres, on approaching the western borders of the great oceans, become deflected in their course, and passing into higher latitudes in the form of south-west and north-west winds, they become identified with the prevailing westerly winds in these latitudes. On the eastern borders of these oceans the air returns towards the equator in the form of northerly or southerly winds, which on crossing their respective parallels of 30°, become merged in the easterly trades, on both sides the equator; the locality, as well as activity, of these aerial circuits, being affected more or less with the change of seasons. This appears to be the great law of circulation in our atmosphere; and it is to the physical character and course of the winds in different portions of these great circuits, that the peculiarities of temperature and climate which pertain to certain countries lying in the same latitudes, but on opposite sides of the same ocean, is chiefly to be referred; as also the remarkable absence or predominance of *rain* in certain countries and latitudes. The Monsoons of the Indian seas are but a modification of the same system of circulation. Counter circuits are sometimes formed in subordinate basins, and in high latitudes; the irregularities usually becoming greater in proportion as we recede from the equatorial regions.]

In Great Britain, westerly are to easterly winds, as 223 to 140. The northwardly are to the southwardly as 192 to 173. And the north-east are to the south-east, as 74 to 54.

At London, south-west winds blow 112 days; north-east 58; north-west 50; west 53; south-east 32; east 26; north 16; and south 18. The mean of Great Britain is 220 westerly, and 145 easterly. In the torrid zone, the winds are constantly north-east on the north of the equator, and south-east on the south side.

[In the state of Vermont it has been noticed that their north-west and west winds always begin on the sea side.

In Lower Canada and over the St. Lawrence, the reigning wind is the south-west, and next to it the north-east. Very often the North-west is unknown while it blows in Maine and Nova Scotia.

In almost every country, as well as in every sea, the wind is more or less predominant in a particular direction.

From the average rate of sailing of ships during long voyages through various seas, as in the China trade, and from other data, it is estimated that the average velocity of the wind near the surface of the ocean is equal to 18 miles an hour throughout the year.

Notwithstanding these general and determinate horizontal movements, the equal distribution of the atmosphere over the surface of the globe, which results from gravitation, tends to prevent any very rapid or violent motion in any specifick direction, and consequently to prevent violent and destructive winds. But, owing to the tendency of all fluid matter to run in whirls, or circuits, when subject to the influence of unequal or opposing forces, a rotative movement of unmeasured violence is sometimes produced. This peculiar movement which in its most active state is sometimes distinguished by the name of tornado or hurricane, assumes every possible variety of position, appearance, velocity, and extent; and is the only *known cause* of violent and destructive winds or tempests.

The various phenomena and effects which result from this cause, are usually considered as distinct meteors, and are variously named in different countries, according to their sensible appearances, intensity, extent, and duration. Such stormy meteors are distinguished by the following among other names, which are often applied in an indeterminate manner and sometimes to the same, or modifications of the same phenomena.

Class 1st. *Aerial meteors or phenomena constituted by whirls or violent movements of limited extent.*

Flaw
Whirl
Gust
Rush of wind
Whirlwind
Helm, or Helm wind

Spout
Waterspout
Sandspout
Sand Pillar
Fire Pillar
Turbo
Turbonado
Tourbillon
Tornado
Bursting of a Waterspout
Falling of a Waterspout
Bursting of a cloud
Squall
Thunderstorm
Hailstorm
Sandwind
Samiel
Simoon

Class 2*d*. *Whirlwind-storms or violent movements of greatly increased extent.*

Gale
Blow
Storm
Pamperro (in La Plata.)
Norther (Mexico.)
Hurricane
Typhoon, or *Tau-fung*, &c.

Names of general or periodical winds of the nature of currents.

Trade Winds
Monsoons
Etesian Winds
Harmattan, &c.]

Wind is determined by the anemometer, by Lind, Daniel, and others, to move with velocity and force, as under :

	miles per hour.	force in lbs. per square foot.
Gentle	4.5	0.079
Pleasant	8.0	0.260
Brisk gale	16.0	1.107
High	36.0	5.208
Storm	62.0	15.625
Hurricane	88.0	31.25
Great hurricane	120.0	58.0

A West India hurricane has blown heavy cannon out of a battery and in exposed situations, walls of solid masonry with strong coping, not exceeding four feet in height, have also been destroyed.

Balloons have travelled 60 miles an hour, when the anemometer showed but 8 miles.

The samiel is a hot noxious wind which sometimes passes over the sandy deserts of Arabia and Africa. It moves with the quickness of lightning, and passes in narrow currents lasting only a few minutes. It occasions instant death to every man or beast who happens to face it, and it is said that it so decomposes them that their limbs fall asunder. The coming of it is indicated by a thick haze in the horizon, and travellers, if they have time, throw themselves on their faces with their feet towards it till it has passed. Hewlitt thinks that it was a samiel that destroyed the army of Sennacherib.

The sirocco is a blighting hot wind which prevails in Italy, &c., about April.

In 1813, a caravan of 2000 persons was buried by a tornado of sand, between Muscat and Aleppo, only 20 escaped.

[The Harmattan is an east wind of great dryness, which visits the western coast of Africa in the low latitudes, in the months of January, February, and March. It is probably the true trade wind, which ordinarily does not act in these regions as a surface wind, but passes in a higher stratum.

The Helm wind is a violent whirlwind, peculiar to the western side of the Cross Fell mountain in Cumberland; and it occurs only during an easterly wind. Whirlwinds of the same character are not uncommon in other regions where obstructions are presented to the regular wind.

Whirlwinds of great extent always act horizontally; those of small dimensions act either horizontally or vertically, or at any intermediate angle of inclination. Many of this smaller class of whirlwinds occur in the atmosphere which do not reach the surface of the earth, and can be recognised only by the sensible phenomena which they produce. The most obvious of these characteristicks are, the cloudy pipe or pillar, called the waterspout; thick masses of turbulent clouds; thunder and lightning; often repeated or continuous thunder, or lightning; a continued roar in the atmosphere resembling the noise of a loaded waggon driven rapidly on frozen ground, or in some cases like the continued discharge of artillery and

small arms; hail of uncommon size in a circumscribed locality or running in veins; large drops of rain; a deluge of rain falling in a small compass; the falling of sand, ashes, small fish, reptiles, and other matters previously taken from the surface; &c. &c.

Whirlwinds of whatever form or extent, and however active or violent their revolutions, move forward only with the velocity of the more regular wind by which they are impelled.

In clear, calm, and sultry weather, whirlwinds have been excited by extensive fires, burning simultaneously in a large circle, and have exhibited violent and continued electrick explosions, and the peculiar phenomenon of the *turbo* or whirling pillar, with other of the above characteristicks.

Volcanick eruptions often excite whirlwinds of great altitude, and of the most violent character.

Thunder storms are supposed to be whirlwinds, gyrating, in ordinary cases, on a horizontal axis of rotation. The wind which they exhibit often blows with a velocity greatly exceeding the progress of the thunder storm, as is the case with other whirlwind storms.

The presence of warm and humid air is supposed to be necessary to the production of violent electrical phenomena, such as thunder and lightning. The latter phenomenon is generally caused by the commingling of air, of different temperature and condition.

Hurricanes are the most violent and destructive storms of the Atlantick ocean. They are of the whirlwind character, and the direction of their rotation in the North Atlantick is from right to left, horizontally. In the latitudes of the West Indies, their general course or *drift* is towards the west, inclining, however, gradually to the northward. About the parallel of 30° their progress to the westward ceases, and passing into higher latitudes they pursue an easterly course, on a track nearly parallel to the American coast.

A hurricane which occurred in August 1830, has been traced from near the windward islands of the West Indies to the coast of Florida and the Carolinas, and thence to the banks of Newfoundland, a distance of 3000 miles, which was passed over by the storm in about six days. The width of the track exposed to the influence of the storm, in different degrees of violence, was from 300 to 600 miles; and its duration at each point from 12 to 24 hours, its greatest violence being exhibited in from 6 to 12 hours. Many other storms have been traced in like manner and on a corresponding track.

In the West Indies, hurricanes begin to blow from a northern quarter of the horizon, and thence changing to the west and round to a southern quarter, and then their fury is over. These phases however will be found somewhat different towards the two opposite margins of a storm's track, and also in positions which are sheltered in some directions from the action of the storm by elevated land. On the coast of the United States these storms commence blowing from an eastern quarter which corresponds to the change in their line of progress, and exhibiting changes of a like character, they terminate with fair weather from a western quarter.

The direction of the wind and the progressive changes in great storms, are found to accord with the locality or position of the storm in the great oceanick circuit of wind or atmospherick current. In the southern hemisphere the course and changes of such storms appear to be *counter* to those in the northern hemisphere. Thus storms in the northern latitudes in certain circumstances blow first from the *southeast* and then change to the north-west; while in New-Holland, storms in like circumstances blow first from *northwest* and then change to southeast.

Little is known of the direction of the wind upon the highest mountains, but in Peru and at the Sandwich islands at the height of about 18000 feet it is found to be fresh from the southwest, and on the peak of Teneriffe about 10000 feet above the sea a strong wind blows from the west.

Volcanick ashes when carried into the higher regions of the atmosphere are usually wafted to the eastward. Upon an eruption of Mount Vesu-

vius in 1631, a shower of ashes fell upon the coast of continental Greece and also at 100 leagues distance towards the coast of Syria. On the eruption at St. Vincent in 1812, ashes were deposited at Barbadoes 60 or 70 miles eastward, and also on the decks of vessels 100 miles still farther east, while the trade wind at the surface was blowing in its usual direction. In the same year ashes fell upon the deck of a British packet bound to Brazil, when distant nearly 1000 miles from the nearest land.

Nearly all the sensible phenomena of the atmosphere occur below the height of 18000 feet, and generally much nearer to the earth's surface. Owing to the retardation of the surface winds and to other causes, the currents in the lower atmosphere run upon each other in horizontal strata, which differ much in temperature and hygrometrical condition as well as in the direction and velocity of movement. It is to the condition of these strata and their influence upon each other that the formation of clouds and rain is chiefly to be ascribed.

The wind goeth toward the south, and turneth about unto the north; it whirleth about continually, and the wind returneth again according to his circuits. All the rivers run into the sea; yet the sea is not full: unto the place from whence the rivers come, thither they return again. This is probably the best epitome of meteorology extant. Whether its comprehensive accuracy be partly owing to an imperfect translation, it is not necessary to inquire.]

Showers of frogs, fishes, &c. arise from water-spouts, or spiral eddies, [whirls] by which portions of the waves of the sea and ponds of water, with their contents, are forced to an elevation; and thus being transported to a distance, and there falling, produce these strange precipitations. A water spout or whirlwind often works spirally like a cork-screw, and moves along like an eddy in agitated water, till its force is scattered, and its contents fall; it commonly begins revolving at the bottom of a cloud which descends within it, and from which pillar-like appearance the term water spout has been derived.

The thermometer was invented by Santorius and Drebel in the 16th century. To convert degrees of Reaumur into Fahrenheit, you multiply by 9, divide by 4, and add 32. But to convert Fahrenheit into Reaumur, you subtract 32, multiply by 4, and divide by 9.

Fahrenheit, a merchant of Dantzick, invented his thermometer in 1720.

Every point of the Mariner's Compass is $\frac{360}{32} = 11\frac{1}{4}°$ — or a half 5° 37′ 30″, and a quarter 2° 48′ 45″.

The ordinary pressure of the atmosphere, on a square foot, is 2158 lbs.; on an inch, 15 lbs. equal to 30 inches of mercury, or 34½ feet of water; for a cubick inch of mercury weighs half a pound, and a cubick foot of water, 62½ pounds.

The barometer, in the temperate zones varies 3 inches from 28 to 31, but between the tropicks but ¼ of an inch.

[In the tropical latitudes the pressure of the atmosphere is nearly uniform, the mercury in the barometer standing at about 30 inches throughout the year. In higher latitudes the pressure is more variable.]

Barometers are used to indicate the height of mountains, because the elasticity diminishes as the aerial space enlarges. The rule is as follows: To substract the logarithm of the number of inches at the top from the logarithm of the number of inches at the bottom, and the difference multiplied by 60,000, gives the elevation in feet. Then to correct this by the variation of the thermometer at the two stations, shift the decimal point three places to the left and multiply by twice the sum of the degrees on the thermometer at top and bottom; add this to the first determination, and the sum will be the true elevation. For example, in the case of Snowdon, the barometer at bottom is 30.091, and at top, 26.439; the difference of their logarithms is 0.5614, which multiplied by 60,000, gives 3668.4; to correct which, 3.37 × by 50.8 as above, = 171.2 × 3668.4 = 3589.6, the true height.

There is another rule by the proportion of the sum of the two heights of the barometer to their difference,

as 52,000 to the height; thus, in the case of Snowdon, as 56.53 is to 3.652, so is 52,000 to the height which is to be corrected for difference of heat as before. The number 52,000 being a constant quantity in this ratio.

The variations in the barometer from the expansion of heat, are in this climate from the 10th to 20th of an inch. The variation depends upon the varied elasticity of the air. From 10 in the morning to 4 in the afternoon, between the tropicks, the barometer falls: it rises till 10 at night, falls till 4 in the morning and rises again till 10 in the forenoon, in all about a 500th part of the entire elevation. There is much quackery in the words usually written on the plates of barometers as the changes indicated depend on several circumstances, besides the elasticity of the air.

Torricelli, a pupil of Galileo, having discovered that no principle of suction existed, and that water did not rise in a pump, owing to nature's abhorrence of a vacuum, imitated the action of a pump with mercury, and made the first barometer in 1643, and Descartes explained the phenomena. Suction was, however, defended all over Europe, and atoms were supposed to be provided with hooks, by which both suction and attraction were effected. In 1654, Otto Guericke, of Magdeberg, made the first air pump which opened a new field to science, and by the use of which, Boyle in England, acquired fame.

The surface of mercury in a barometer in rising is convex, because the friction of the central parts of the fluid mercury, is less than the friction of the mercury at the sides next the glass; and in falling it is concave for the same reason, i. e. the increased friction between the glass and mercury detains the ring next to it. The local atmospheres between the glass and mercury, are also concerned in this phenomenon.

If the atmosphere were of equal density, the rise of the barometer would indicate a rise of five miles, but the rise of the barometer depends more on the elasticity than the density, and, therefore, is not a criterion of the height.

The greatest depression of the mercury in England has been to 28.1 inches.

Barometers rise and fall together even at great distances. They fluctuate less at elevations above the sea. Northerly winds raise them, southerly winds sink them.

[The fluctuations of the barometer appear to be owing to different causes, and may be classed as follows:

1st. The regular semi-diurnal variation, which, in the tropical latitudes is at its maximum about 10 A. M., and at its minimum about 3 P. M. At New-York it is nearly the same, but in very high latitudes the effect is reversed, the minimum being at 10 and the maximum at 3 o'clock. It appears to indicate a system of atmospherick tides, resulting from the rotation of the earth and its connexion with the solar system.

2d. The variation which results from the mechanical action of circuitous winds and the larger atmospherick eddies, which comprise not only the storms but a large portion of the winds in the higher latitudes. During the passage of these eddies or storms over the place of observation, the barometer sinks while under their first or most advanced portions, and rises as they pass over or recede. The most prominent variations of the barometer are of this character.

3d. The general movement or oscillation of an extensive region of atmosphere in the higher latitudes, under the alternately predominating influence of centrifugal action towards the equator, and gravitation towards the poles. These extensive oscillations are infrequent, and nearly uniform in their effect on the barometer over an extensive region of country at nearly the same time.

The extent of the vibrations of the column of mercury between the tropicks was .067.

The highest range in the polar regions observed by Capt. Parry, was 30.86. During a violent storm or hurricane the barometer has sometimes fallen below 28 inches.

The fall of the barometer has no necessary and immediate connexion with rain, although storms of wind which effect the barometer are often

attended by rain. It appears from the observations of the Marquis Poleni, that in 1175 instances of falls of rain, the barometer sunk only 758 times, being 645 to 1000. The most copious rains sometimes fall during an unusual elevation of the barometer.

The prognostications of rain and fair weather which are usually affixed to the scale of the barometer, are entitled to no attention, and often serve to discredit this valuable instrument. Changes of weather are indicated, not by the actual height of the mercury, but by its change of height. Violent storms of wind are always preceded by a fall of the barometer, and one of the most general rules is, that when the mercury is very low, high winds may be expected.]

Capillary attraction is an effect or motion of parts of fluids when the general pressure on the mass is intercepted by any intervening solid. Thus in a barometer or pump-bore the pressure is taken off in the tube or bore, while it continues on the outer surface: if a solid be placed in the water the water rises round the solid, because the solid intercepts the pressure on its own side. If two solid plates are brought together, the water rises much higher, being pressed upon only through the sides. If the plates are closed at the side, as in the manner of a tube, the water rises in the tube in proportion as the bore by its smallness, diminishes the downward pressure. If a solid of less specifick gravity than mercury be immersed in mercury, the pressure acts more on the solid than the mercury, and occasions a depression. If water be placed under the receiver of an air pump, it becomes vapour, or so much becomes vapour, as by its elasticity to sustain the remainder as vapour, and hence it will rise in a tube nearly as in the open air. These effects are important, because to them is owing the rise of moisture in the tubes of plants and all saturation. Viscidity varies the ascent, and also density, but in general, the diameter of a tube multiplied by the height is a constant quantity. Experimenters find great varieties in the results which are occasioned by moisture, for the atmospheres of similar atoms or bodies combine, and thus, atoms of water in a tube facilitate ascent. Two plates, after immersion, sustain a plate of water, but if dry, scarcely any will rise between them. It is this principle of intercepted pressure which occasions a plumb line to incline towards a mountain, and boats to congregate about a ship, and small corks about a bung, but if the bung is as dense as the water, and floats below the water, the corks are not acted upon; from like cause, floating bodies are pressed towards the side of a vessel. In a capillary tube, one-hundredth of an inch in diameter, different experimentalists have found water rises in such tube, 2, 3, 4, and 5 inches, but this depends on the length of the tube, because the downward pressure from the top would be as inversely as the length, from the fluid to the top. With a tube, one-twenty-fifth of an inch in diameter, Martin found that spring water rose 1.2; vinegar, 9.5; milk, 0 8; oil, 0.6; rum and brandy, 0.5; depending, of course, on the viscidness. Philosophers have published many theories on these subjects, but the labours of Dr. Young are most to the purpose.

When a capillary tube is the 50th of an inch, *water* rises in it 2½ inches; when the 100th, 5 inches; and when the 200th, 10 inches. When two plates of glass are placed at an angle in water it rises 2½ inches, where the plates are the 100th of an inch asunder, and 5 inches where the 200th, or half the height which it rises, where the pressure of the air is closed all round, as in a capillary tube. The rise in both cases being entirely owing to the intercepted pressure of the atmosphere by the glass, and depending on the angle which the top of the tube forms with the water, being less and less as the bore or angle is enlarged.

Water will not rise between cakes of wax or grease, and oil of turpentine rises but one-fourth, but spirits of wine rise two-fifths. Mercury sinks round glass or any substance lighter than itself, and water sinks when the tubes are made of lighter substances; the experiment in those cases, being reversed or at right angles to the former.

Common AIR pumps rarify the air from 100 to 300 times, the best from 2 to 3000 times.

ACOUSTICKS.

In air, sound travels from 1130 to 1142 feet per second.

The lowest sound which the ear can discriminate, is, according to some, 12½ undulations in a second, and to others, 30; and the most acute, rather above 6000, and, according to others, 14,000 vibrations per second.

Sound affects particles of dust in a sun-beam, cobwebs, and water in musical glasses; it shakes small pieces of paper off a string in concord. Deaf persons may converse through deal rods held between the teeth, or held to their throat or breast.

In sound, as in light, the angle of incidence is equal to the angle of reflection. The laws of catoptricks apply to sound.

Echoes are distinguished when the time between delivering a sound to its return is more than one-twelfth of a second; and as the sound goes and returns, so, to the speaker, there can be no echo in less than $\frac{1130}{24}$, or 47 feet; and syllables cannot be repeated in less than one-seventh of a second more, or 161 feet for each syllable.

The report of a gun is heard before the word fire, which directs the discharge.

In water, sound passes at the rate of 4708 feet per second.

A bell does not in water produce a tone, but a short noise, like two knives struck together. The agitation of the water produces no change. In the water, a large bell is heard 45,000 feet; but in the air, out of the water, but 656 feet.

The fire of the English, on landing in Egypt, was distinctly heard 130 miles on the sea.

Dr. Jameison says, he heard every word of a sermon at the distance of two miles.

Counter-point, or melody with harmony, as treble and base, was invented by Guido about 1022; and the time-table by Franco, in 1080.

Pythagoras is said to have invented harmonick strings, in consequence of hearing four blacksmiths working with hammers in harmony, whose weights he found to be 6, 8, 9, and 12; or rather, by squares, as as 36, 64, 81, and 144.

Scotch musick is referred to their James I.

Chanting the Psalms was adopted by Ambrose, about 350, from the Pagan ceremonies of the Romans. Church organs were in general use in the 10th century. The shortest notes in the middle ages were the semibreve and minim, now the longest.

The lyre of the Greeks was the harp of the moderns; and the viol, and vielle of the middle ages, is the modern violin.

The gamut is so called from *gamma*, the third letter of the Greek alphabet, used by Guido for his lowest note. It consists of 20 notes, two octaves, and a major sixth. The first expressed by capitals, the second by small letters, and the rest by double small letters; as G, A, B, &c., g, a, b, &c., and gg, aa, &c. It is now extended to the entire scale of five or six octaves.

In musical compositions there are two species of keys, the major and minor; the sharps and flats being referred to C major or A minor.

A sharp is half a tone higher: a flat half a tone lower.

Large bells are one-fifteenth of the diameter thick, and one-twelfth of the height. Bell metal is made of copper and tin. Small bells made of tin, silver, copper, or gold, give sounds in acuteness, as 253, 266, 282, 294, respectively. They were used in English churches about 700, and for that purpose consecrated with peculiar ceremonies: some say baptized, and had proper names given them. Popes themselves assisted in this absurdity. They were supposed to put demons to flight, and were rung during eclipses, to drive away the dragon which was about to devour the moon; and which dragon the astrologers still recognise, by calling the northing node the dra-

gon's head, and the southing node the dragon's tail, to which they ascribed potent effects. On St. John's Day, they were rung furiously, to put his devils to flight and prevent the storms. A Popish council, by formal decree, directed that bells should be blessed to affright demons and witches, avert lightnings and whirlwinds, and baffle the spirits of the storm; and, for the benefit of departed souls, bells were to be tolled; nine knells given for a man, six for a woman, and three for a child; a custom which still continues. The great bells at Pekin weigh 120,000 lbs., and there are seven of them. The great bell at Moscow is 70 feet in circumference, and 21 feet high, and weighs 444,000 lbs.; that at Erfurt weighs 252,000 lbs.; and the clapper, 12 feet long, weighs 1100 lbs. The cathedral, at Antwerp, has a musical combination of 33 bells, the largest seven feet wide and eight feet high.

Church organs are in two parts, the main and the little organ before the other. The largest pipe expresses the size, as 8, 16, or 32 feet organs. That at Ulm is 93 feet high and 28 broad; its largest pipes 13 inches bore, with 16 pair of bellows.

The organ was invented by one Ctesibius, a barber of Alexandria, about 100 B. C.

The organ in the new church, at Amsterdam, has 52 whole stops, besides half-stops, and two rows of keys for the feet and three for the hands; and a set of pipes that imitate a chorus of human voices.

The Hon. Robert Boyle believed, that the sound of a drum, made of wolf's skin, would break another made of sheep's skin; and that a harp, strung with fox-gut strings, would make hens fly away. His philosophical writings, and even those of Lord Bacon, abound in superstitions of this kind.

The bag-pipe, a Celtick musical instrument, much used in the Highlands and Ireland, is composed of a leathern bag: connected is a pipe or chanter, with a reed, and the passage of the air from the bag produces the tones. These are all drones, two in unison with D on the chanter, and a long drone an octave lower.

M. Kempelon, a Hungarian, lately made a speaking machine. It consisted of a reed or glottis—of an air-chest with valves, bellows for lungs, a mouth and jaws, and nostrils. It pronounced most letters perfectly, but D, K, G, and T, imperfectly; and even long words and sentences with great facility.

The organ, at Weingarten, has 66 stops and 6666 pipes; and that at Haerlem has 60.

The famous Temple organ, in London, was erected by competition of Schmidt and Harris, two famous builders; and, after long-protracted disputes about their merits, the question was referred to Mr. Jeffries, afterwards Chief Justice, and he decided in favour of Schmidt.

The pianoforte was invented in London, about 1766, by Zumpi, a German.

The lyre, the harp, the flute, and the violin, were known to the Romans.

Sounds are more intense as the air is denser, and they die away on the exhaustion proceeding under a receiver. Water is a better conductor of sound than air. Wood also is a powerful conductor of sound, and so is flannel or riband. Gunpowder makes no report under an exhausted receiver. Sounds are distinct at twice the distance on water that they are on land. Sound travels about 900 feet for every pulsation of a healthy person, at 75 in a minute.

In the arctick regions, persons can converse at more than a mile distant, when the thermometer is below zero.

PHYSICAL GEOGRAPHY.

[Physical Geography, or natural geography, as it is sometimes called, relates to the principal features of the earth's surface, and comprises also a knowledge of the climate, temperature, winds, currents, and other natural causes which affect the condition of various parts of the earth and its inhabitants.

The most general view of the globe presents us with the two great divisions of land and sea.

There is, in fact, only one continuous fluid surrounding the land,

all the gulfs and inland seas being branches of this universal ocean; but for the sake of convenience, different parts of it have distinct names given to them.

The following are the principal seas into which the ocean has been divided, as will be clearly understood by referring to the map of the world.

I. The great basin of the Southern and Pacifick oceans, the waters of which cover nearly half the globe. It includes,

1. The *Antarctick Ocean*, which is comprised between the antarctick circle and the south pole.

2. The *Southern Ocean*, the boundary of which on one side, is the antarctick circle; on the other, a line drawn from Cape Horn to the Cape of Good Hope; thence to Van Dieman's Land; and again by the south of New Zealand to Cape Horn. These two divisions are sometimes with propriety called the *Great Southern Ocean.*

3. The *Indian Ocean*, lying between Africa on the west, and the peninsula of Malaya with the islands of Sumatra, Java, &c. and New Holland on the east, and bounded by Persia and Hindostan on the north. The Red Sea or Arabian Gulf, the Persian Gulf, and the Bay of Bengal, are all parts of this ocean.

4. The *Pacifick Ocean*, divided by the equator into *north* and *south*, and enclosed between America on the east, and New Holland, the islands of Java and Sumatra, and the continent of Asia, on the west. On the north it terminates at Behring's strait. The seas of China, Japan, Okotsk, &c. form parts of this ocean.

II. The great Atlantick basin, forming a channel between the old and new continents. It includes,

1. The *Atlantick Ocean*, commencing in the south, from a line drawn from Cape Horn to the Cape of Good Hope, and terminated on the north by the arctick circle. It is divided into *north* and *south* by the equator, and its branches are the Mediterranean, the North Sea or German Ocean, the Baltick, Baffin's Bay, Hudson's Bay, the Gulf of Mexico, and the Caribbean Sea.

2. The *Arctick Ocean*, surrounding the North Pole, and bounded by the arctick circle, and the northern shores of the two continents. The White Sea, the Sea of Kara, and the Gulf of Obe, are parts of it.

The ocean is spread over nearly seven tenths of the globe; and the land and water are very unequally distributed between the northern and southern hemispheres. The following calculation will plainly exhibit this fact:

Considering the whole space included in the northern part of the torrid zone, as equal to 1, the proportion of land is 0.297
On the same supposition, the proportion of land in the northern temperate zone is 0.559
And in the northern icy zone, 0.400
In the southern part of the torrid zone, the portion of land is 0.312
In the southern temperate zone, 0.075
In the southern icy zone, nearly none.

In other words, if the quantity of land in the northern hemisphere be represented by 16, the quantity in the southern will be scarcely equal to 5.

The general direction of the land in the two continents is entirely different. In America it is from pole to pole; in the old world it is from south-west to north-east. In both continents the direction of the large peninsulas is similar, almost all of them running towards the south. This is the case with South America, California, Florida, Alaska, and Greenland in the new world, and in the old with Scandinavia, Spain, Italy, Greece, Africa, Arabia, Hindostan, Malaya, Cambodia, Corea, and Kamtschatka. The only exceptions are the peninsula of Yucatan in Mexico, and that of Jutland in the north-west of Europe. The two continents differ from each other very much in the character of their outlines, for while the coast of the old world is broken on all sides by gulfs, bays, and inland seas, the new world has a series of openings on its eastern shore only. Of its western side, the only inlet of any magnitude is the gulf of California.

Mountains are the most considerable elevations of the surface of the earth. Mountains are most commonly so near to each other, and are disposed in such a manner as to give the idea of *chains;* which term ap-

plies to series of mountains, the bases of which are continuous. The most remarkable of these are long connected chains, like the Andes and the Chippewan or Rocky mountains, which continue for several thousand miles nearly in one direction, having on both sides inferiour ranges, but sending off hardly any secondary chains.

Some mountains are completely insulated, that is, are quite remote from any chain or group. Volcanoes are more particularly of this kind.

The character of mountains would seem to depend upon the sort of rock of which they are composed. Granite, when exposed, forms lofty and rugged elevations; gneiss is much less precipitous, and slate commonly not at all so. In this respect there is a remarkable difference, which Humboldt has noticed, between the old and new continents. In the former, the highest points of the Alps consist of granite; but in America granite is not found higher than 11,000 or 12,000 feet above the level of the sea, and the newest floetz; trap or whinstone, which in Europe appears only in low mountains, or at the foot of those of great magnitude, covers the tops of the Andes. Chimborazo and Antesana are crowned with vast walls of porphyry; and basalt, which in the old continent has not been observed higher than 4,300 feet, is on the very summit of Pichinca. Other secondary formations, among which may be mentioned limestone, are also found at greater heights in the new than in the old world.

The following is a table of the height of some of the principal mountains on the globe, reckoning from the level of the sea.*

		Feet.
EUROPE.		
Mount Blanc,	Alps,	15,668
Mount Rosa,	Alps,	15,527
Jungfrauhorn,	Alps,	13,730
Wetterhorn,	Alps,	12,500
Pass of Gt. St. Bernard,	Alps,	7,968
Do. of Mount Cenis,	Alps,	6,778
Do. of the Simplon,	Alps,	6,580
Nethon,	Pyrenees,	11,427
Perdu,	Pyrenees,	11,275
Monte Corno, (Appenines,)		9,523
Etna,* in Sicily,		10,870
Vesuvius, near Naples,		3,932
ASIA.		
Dhawalagiri,	Himalaya,	28,077
Jewahir,	Himalaya,	25,747
Monna Roa, (Sandwich Is.)		15,988
Ophir, (Sumatra,)		13,840
Egmont, (New Zealand,)		11,430
Ararat, (Armenia,)		9,600
Awatsha,* (Kamtschatka,)		9,600
Lebanon, (Palestine,)		9,600
AFRICA.		
Geesh, (Abyssinia,)		15,000
Atlas, (Morocco,)		11,980
Peak of Teneriffe,*		12,180
AMERICA.		
Chimborazo,	Andes,	21,425
Antesana,*	Andes,	19,136
Cotopaxi,*	Andes,	18,867
Pichinca,*	Andes,	15,931
Popocatepetl,*	Mexico,	17,720
Iztaccihuatl,	Mexico,	15,705
Lake of Tobica,	Mexico,	12,195
Silla de Caraccas, (Venezuela)		8,633
Itacolumi, (Brazil,)		5,756
Mt. Washington, (New Hampshire,)		6,650
Blue Mountains, (Jamaica,)		7,278
Mount St. Elias,		17,863

It is remarkable that in the old continent the principal chains of mountains contain no volcanoes, and that islands, and the extremities of peninsulas, are alone the seats of these convulsions; while in the new world, the immense range which runs along the shore of the Pacific Ocean possesses more volcanoes than are found in the old continent and its adjacent islands.

Professor Jameson has given the following estimate of the number of volcanoes:—

Continent of Europe, ...	1
Islands of do.	12
Continent of Asia, ...	8
Islands of do.	58
Continent of America, ...	97
Islands of do.	19

No volcano has yet been discovered on the continent of Africa, but most of its groups of islands are distinguished by them.

Several mountains bear evident marks of having, at some distant period, been the outlet of fires; and on this account they are called *extinct* volcanoes.

It has sometimes happened, that

* For a more complete table, see Part II. of the Treasury of Knowledge.

(Note.) Those marked * are volcanoes.

new islands have been formed during *submarine* eruptions. An instance of this kind occurred in 1811, in the neighbourhood of St. Michael, one of the Azores, which lay about 800 miles west of Portugal. This new island has since disappeared. More recently a new island has appeared in the Mediterranean, near the island of Sicily, which disappeared after the lapse of a few months.

A considerable portion of the islands of the globe, are found to be of volcanick origin.

Many islands, especially those in the South Sea, owe their origin to the marine insects which produce the coral. Some, are banks of sand, just raised above the surface of the water.

The bottom of the sea appears to have inequalities similar to the surface of the continents; the depth of the water is therefore extremely various. There are vast spaces where no bottom has been found; but this, of course, does not prove that the sea is bottomless, because the line is able to reach but a comparatively small depth. If we were to found our opinion upon analogy, we might conclude that the greatest depth of the ocean is equal to the height of the loftiest mountains, that is, between 20,000 and 30,000 feet.

The level of the sea, if it were not for the action of disturbing causes, would be the same every where at the same instant, and the figure assumed by the ocean would be the true surface of the planet, that of an oblate spheroid. But the tide at any given moment, is at different heights in different parts of the ocean.

Water being a bad conductor of heat, the temperature of the sea changes much less suddenly than that of the atmosphere, and is by no means subject to such extremes as the latter. The temperature of the sea never, in any latitude, exceeds 86 or 87 degrees of Fahrenheit.

The existence of banks or shallows have a local effect in diminishing the temperature of the ocean, but the great agents in modifying it are currents, which mingle together, or change the locality, of waters of different regions. Thus the gulfstream, as it is called, which sets into the gulf of Mexico from the equatorial regions, is much warmer than the neighbouring parts of the sea; the current of Chili is just the reverse, being in its progress from the higher to the equatorial latitudes, from whence it passes across the wide Pacifick, and carries the warmth which is thus acquired, again to the higher latitudes, on reaching the western borders of that ocean.

There are three kinds of movements constantly going on in the waters of the sea—1. The agitations which its surface undergoes by the action of winds—2. Tides, which are the result of the attraction between the earth and the sun and moon—3. Currents, which arise from different causes, some of them existing within the element itself.

The influence of the moon in producing the tides, is commonly supposed to be greater than that of the sun, and evidently governs the time of high water. As the moon crosses the meridian of a place about every twenty-four hours and fifty minutes, the sea, in that space of time, ebbs twice and flows twice, in most parts of the world. In large portions of the Pacifick Ocean, however, as well as in certain other localities, the tides are exempt from the lunar influence. At Tahita and the Georgian group, near the centre of the Pacifick Ocean, the tide rises but one or two feet, and it is high water at noon and midnight throughout the year, and this too, in the very region where the established theory would lead us to expect the lunar tides to be the most regular and powerful. The tides upon the coast of Gautimala, in the Caribbean sea, afford a similar exception. These facts serve to show that the *modus operandi* of the causes which produce tides, is not thoroughly understood.

The impediments created by shallows in the ocean, and by the shores, bays, gulfs, and promontories of islands and continents are such, that the tides are greatly delayed, altered both in degree and direction, and in many places so accumulated, that they rise to heights far exceeding what is witnessed in the open ocean. On the northern coasts of France, the flow being confined in a channel, rises to a surprising height; at St.

Maloes 50 feet. The tide of the German ocean is twelve hours travelling from the mouth of the Thames to London bridge, where it arrives about the time that there is a new tide in the German ocean.

The tide at Chepstow, rises, at high spring tides, 56 feet, and at others from 40 to 50. The tides in the Bay of Fundy are said to rise to an equal height.

Currents and winds have an influence either in quickening or retarding the tide, and a powerful wind will sometimes keep a tide out of very narrow channels. On the contrary a strong wind coming from the same quarter as the tide, will sometimes raise it several feet above its usual level.

Currents in the ocean are either constant or occasional. The most remarkable currents are those which continually follow the same direction. These usually follow the course of the great circuits of wind in every ocean, and besides, have a general connexion with each other, so that much of the oceanick fluid is constantly passing from one basin to another.

The waters of the north Atlantick perform a constant circuit in the parallels between the equator and the banks of Newfoundland, of which circuit the concentrated current of the gulf stream forms a conspicuous part, and in the centre of this circuit of current is situated the great field of floating sea-weed called the grassy sea. Its strength is much aided by the current which passes from the Indian Ocean round the Cape of Good Hope, through the south Atlantick, and which, joining the equatorial current, passes to the northwest into the Caribbean sea.

In the north Atlantick a counter circuit is also formed, which passes near the British islands and the coast of Norway, and enters the polar basin, from whence it returns under the name of the polar current, and passing down the coasts of Greenland and Labrador, carries with it, at certain seasons, the floating ice of the polar regions.

The fruit of trees which belong to the American torrid zone is every year deposited on the western coasts of Ireland and Norway; and on the shores of the Hebrides are collected seeds of several plants, the growth of Jamaica, Cuba, and the neighbouring continent. The most striking circumstance, perhaps, is that of the wreck of an English vessel, burnt near Jamaica, having been found on the coast of Scotland.

It is estimated by Humboldt, that a floating body, which should receive no impulse from the winds, would require thirteen months from the Canary islands to reach the coast of Caracccas, and ten months to make the tour of the Gulf of Mexico, while forty or fifty days might be sufficient to carry it from the straits of Florida to the banks of Newfoundland; and requiring between two and three years to perform the whole circuit back to the Canary islands, equal to a distance of eleven or twelve thousand miles.

The general features of the currents in the north and south Pacifick resemble those in the Atlantick, except that they are obstructed by numerous archipelagos. A Japanese junk, which had been disabled on that coast, has recently been drifted to the Sandwich islands; and pieces of wreck and other articles from the China sea, are often found by the whale ships in the northern Pacifick.

The existence of *under currents*, different from those on the surface, is highly probable and is supported by the analogy of the atmospherick currents, which traverse immense distances in distinct horizontal strata; but their existence is not distinctly proved except by the drift of the icebergs, which are brought into the margin of the gulf stream, during the spring and summer, by the polar current, which then disappears, and from its greater density, probably becomes an inferiour current, passing to the lower latitudes. From the great depth of the icebergs, it probably continues to act upon them after they arrive within the influence of the warmer current of the gulf stream.

An under current is also supposed to exist in the straits of Gibraltar, where there is a constant influx from the Atlantick through the strait; as the wreck of a vessel which was sunk on the Mediterranean side of the strait, is said to have risen again in the Atlantick.

It is common to ascribe the cur-

rents of the ocean wholly to the action of the winds; but, as the waters of the ocean are subject to the same impulses as the superincumbent atmosphere, it is probable that the principal movements of both fluids have their origin in the same causes.

The term *Climate*, expresses that particular combination of temperature and moisture, which exists in the atmosphere of any greater or less extent of country.

The following are the principal circumstances which determine physical climate:—1. The power of the sun's immediate action, which increases in proportion as we approach the equator. 2. Elevation of the ground above the level of the ocean. 3. Position with respect to the great seas, or rather with respect to the great circuits of wind which sweep over those seas and the adjacent countries. 4. Position and direction of chains of mountains. 5. Character of the prevalent winds.

The amount of immediate solar heat depends upon the position of the sun in the ecliptick, which determines the length of the day; and the direction in which the rays fall upon the earth is another important consideration. Bouguer calculated that out of 10,000 rays falling upon the earth's atmosphere, 8,123 arrive at a given point if they come perpendicularly; 7,024 if the angle of direction is 50 degrees; 2,831 if it is 7 degrees, and only 5 if it is horizontal.

By increasing our elevation above the level of the sea, a rapid decrease of temperature will be experienced, till we arrive at the point where constant frost prevails.

The following table from Professor Leslie is designed to show the elevation of the line of perpetual frost in different latitudes:—

Latitude.	Mean temperature at the level of the sea.	Height of curve of congelation.
0	84 Fahr.	15,207 feet.
10	82	14,764
20	78	13,478
30	71	11,484
40	62	9,001
50	53	6,334
60	45	3,818
70	38	1,778
80	33	457
90	32	0

The temperature of the sea has an effect upon the winds which pass over it, and this temperature being more equable than that of the land, tends to equalize the temperature of an island or a maritime country.* The temperature of the ocean, contiguous to any country, also depends much upon the position of that country in relation to the great oceanick currents.

It is the character of the prevailing winds which chiefly, and more immediately, affect the climate of any country situate without the tropicks. The currents of the atmosphere, like those of the ocean, form a system of continued circuits, by which the accumulated warmth of one region is often conveyed to another, and by this means important modifications of climate are produced.

Mountains also affect climate in more ways than one. By causing the condensation of aqueous vapour they occasion copious rains. They also afford shelter from winds; and by their position modify or control the currents of the lower atmosphere, and sometimes occasion great diversities in the climate of countries and places near to each other.

The climate of the United States and Canada strongly illustrate the influence of these causes. The tropical current or trade wind being deflected by the Mexican elevations, enters the great basin of the Mississippi and sweeps freely over the extensive country lying east of the Rocky mountains. Here, by change of latitude, the diurnal motion of the surface becomes less than that of the superincumbent fluid, which therefore necessarily assumes the form of westerly winds, and passes back to the Atlantick, to be in due time again merged in the northeasterly trades. When this tropical current keeps sole possession of the surface, which it often does for days together, extraordinary heat prevails, extending frequently through the entire basin of the St. Lawrence, and sometimes raising the thermometer on the borders of that river, at Montreal, to 98 degrees of Fahrenheit. But in winter, when the locality of this great circuit is changed to a more southern region, and when its current is entirely displaced from the surface of

* See page 175.

the great interiour plateau by the cold winds of the interiour, which come down from the Rocky mountains, or from high latitudes on a course parallel to those mountains, this region becomes subject to all the rigours of a Siberian winter.

The climate of China bears a close resemblance to that of the United States, and the continental and oceanick positions of the two countries are equally analogous. Both countries are subject to the extremes of heat and cold above most others in the same latitudes.

The character of the polar current, and the great quantities of ice which it brings to the northeast coast of America, is supposed to influence the climate of that coast, particularly in the spring months. At Newfoundland, which is in the latitude of Paris, late in the month of June, 1831, the bays and harbours were full of ice.

Owing to the circuitous character of most winds, the temperature of the wind frequently does not conform to the supposed temperature of the quarter from which it blows. Thus at London, during six weeks of the winter of 1831, a north and northeast wind was accompanied by a *thaw*, and a south and southwest wind always by a frost. It should be noted that the great circuit-winds contain, without the limits of the trades, numberless smaller circuits and eddies of every variety of dimensions, which account for the various and opposite directions and apparent instability of the winds in the higher latitudes. In the United States these irregularities are chiefly confined to the surface winds.

The atmosphere is capable of absorbing moisture in proportion to its temperature, and a current of air passing from a colder to a warmer region has therefore a constantly increasing capacity for moisture. This peculiarity necessarily pertains to one portion of each of the great natural circuits of wind, or atmospherick current, in both hemispheres. The necessary consequence is a great scarcity of rain in the regions falling under this portion of the current, and hence those arid deserts which occupy so large a portion of the otherwise most fruitful latitudes.

On examining the map of the world, it may be seen that this scarcity of rain mostly prevails in countries lying upon the eastern borders of the great oceans, and of their atmospherick circuits, and between the 18th and 32d parallels of latitude. On the western borders of the Atlantick, in both the Americas, where the aerial current is passing from the lower to higher latitudes, there are abundant supplies of rain. The same is true also of China and the eastern coast of Africa, and also of the western shores of the Pacifick generally, except as the effect is modified by the misplaced counter current of the Monsoons. But not so on the eastern shores of these oceans, where the atmosphere which forms the extratropical winds, falling in again towards the equator, presents a constant demand for additional moisture, and parches and desolates extensive regions of country.

In the atmospherick basin of the North Atlantick, we have the most striking exhibition of this effect in the great African desert of Sahara. Continuing our survey on the same parallels, we have also the great deserts of Lybia, Egypt, and Arabia, subject for the most part to the same course of the atmospherick currents, and exhibiting the same disastrous effects. In the basin of the south Atlantick we have, on its eastern shore, in South Africa, a barren desert, extending across the same latitudes, and spreading from the shore to the mountains. Over this region prevails a constant southerly wind, being that section of the great southern circuit which is pursuing its way to the tropicks. On the eastern shore of the South Pacifick, in the same latitudes, we have also the coast of Peru with a corresponding section of southerly or circuit wind, a coast which is known to be proverbial for the total absence of rain.

In Egypt the surface winds are periodical, but northerly winds predominate; the south wind in winter being the coldest.

Near the Canary islands, the trade wind blows from N.N.W. to N.E., the medium direction being N. by E.

In the most favourable region for the trades, in the Pacifick, lat. 12° S., lon. 177° E., the prevailing winds, during near four months in the year, blow strong from W.N.W.]

HISTORY AND LAWS OF ENGLAND.

The name of England is derived from a village near Sleswick, called *Anglen*, whose population joined the first Saxon freebooters. Egbert called his kingdom Anglesland. Anglesey means England's Island, *ey* in Saxon being island.

The Anglo-Saxons came from the district watered by the Weser and Elbe. It was inhabited by the Saxons and Angles. The Saxons had a nobility called Thanes, or Eoldermen and Eorls, and there were greater and less Thanes. The people were yeomen, or independent farmers; while the mass of the commons were slaves, being bought and sold with the land, and treated like the modern negroes. The wittinage-mot was a sort of annual parliament, for public purposes. There was also a shire-mot twice a year, in which our assizes originated; and a wapontak or hundred-mot. Below all, a tithing of 10 families.

The Celts were the ancestors of the Britons and modern Welsh, Highlanders, and the northern Irish. Of their origin nothing is known; but they were a distinct race from the Goths or Scythians, in language, religion, customs, and person. Their druids had a great affinity to the modern Bramins in ceremonies and faith. The Welsh Archeology mentions the coming of Prydain and his three sons from Gaul; but it seems probable that, at a remote period, the countries were united. May not the Celts have been colonies from Atalantis, mixed subsequently with Phœnicians, Gauls, and Carthaginians?

The Celts, or Cimbri, were the first inhabitants of Britain, and the Welsh are their descendants. The Goths, or Scythians, drove them into their mountains, and the Welsh call themselves Cymri or Coomry. The Highlanders and northern Irish are the same people; but the southern and western Irish are from Gallicia and Carthage, and their language is the same as the Punic. Whitehurst conceives that Ireland was a portion of the ancient Atalantis. The religion of the druids, in many of its details, resembles that of the Hindoos; but the Gauls, or Gallicians of Ireland and the Highlands, were fire-worshippers, and perform ceremonies to Baal, or the Sun, to this day.

Colonel Wilford found, in the books in the Sanserit, accounts of the White Island, and it is referred to as the residence of Vishnu; and he publishes another tract, descriptive of what is called the Churning of the Sea, such an event as would form the basaltick columns in the north, and as, perhaps, absorbed Atalantis.—*Asiatick Researches.*

The earliest records of the histories of this island are the manuscripts and poetry of the Cambrians, who were the aboriginal inhabitants, corroborated by their monuments, consisting of stone erections of temples and altars of worship, as Stonehenge, Aubury, and various cromlechs; and also barrows, or tumuli, for burying the dead, often large and extensive.

These manuscripts show, and the monuments confirm, that, in a very remote age, a people on the Euxine, called Cymry, or Kimri, were conducted to Britain by Hu, called the Mighty; and that his son, Prydain, established laws and a government, and gave his name to the country.

Previously the country was covered with forests, like America at present, and inhabited by bears, wolves, wild boars, foxes, deer, and other wild animals.

The language of the first settlers was the same as that spoken in Wales at this day, of which the Irish, and Erse of the Scotch highlands, are dialects, similar to the Phœnician and Carthaginian, with many Greek words; and the religion was the worship of the sun and fire, such as prevails in the countries near the Euxine.

The simplicity, perfection, and copiousness of the Welsh language, the altars still found in Ireland dedicated to Baal or the sun, the custom in Ireland and the Highlands of passing through fires at Midsummer, practised even to this day, just as among ancient eastern nations, are confirmations.

That Britain formerly joined the continent has been inferred from the similar cliffs of the opposite coasts, of the English channel, and from the

constant encroachments of the sea in still widening the channel.

The descendants of Hu and Prydain maintained the government, according to some writers, till the arrival of some bands of fugitive Trojans, about the years 1100 or 1200 before Christ, under Brutus, who, landing at Totness, established a government; and, at his death left England to his son Leucrine; Wales, to his son Kamber; and Scotland, to his son Albactanus.

This account seems, at first, to have been published by one Geoffrey, a historian, of Monmouth, from an ancient manuscript, said to be brought from Armorica, or Brittany, a colony from Britain. And it was confirmed by others, believed by Shakspeare, who founded on it his tragedy of *Lear*, one of the kings descended from Brutus, by Raleigh, and by Milton; also by Henry VII., who published his pedigree in a direct line from Brutus, in proof of his title to the throne.

In 55, before Christ, Britain was invaded in Kent by Julius Cæsar, who, after marching beyond the Thames, and building Dover Castle, withdrew the Romans; but, in 43 after Christ, the Romans invaded it again, and conquered the whole island, except the mountainous parts of Wales and Scotland.

Britain at that time, according to Cæsar, who wrote as an enemy, was semi-barbarous; but it appears that they had war-chariots and arms, and fought with discipline and bravery, and had a body of priests, called druids and bards, by whom they were chiefly governed in 17 states or principalities.

Cæsar alleged they had assisted the Gauls, with whom he had been at war; but the Welsh chronicles relate, that the British Prince Caswallawn had landed in Gaul, and put 6000 Romans to death, in recovering a princess, named Flur, from Cæsar, to whom he was betrothed.

Claudius, 100 years after, renewed the invasion, partly to employ the turbulent Roman soldiery, and partly owing to the treachery of a British Prince Avarwy, son of Lludd, who invited and assisted the Romans.

About the commencement of the Christian era, the language of the whole Island was probably Celtic, or that now spoken and written in Wales. In the north of Scotland lived a tribe of Norwegian settlers, who, continuing to paint their bodies after the fashion had ceased in the south, were, by the Romans, called *Picti*. The western islands and mountains of Scotland were peopled by a brave and high-spirited race from Ireland; but the Lowlands were occupied by a mongrel race of Scandinavians, Germans, run-away Britons, and others constituting *the Scots*, needy, greedy, and glad to receive aid in their marauding excursions, from the hardy and barbarous Picts, who, it is stated by St. Jerome, were cannibals. Three hundred years before, Ireland had given them a king of the name of Fergus; but their savage annals exhibit little but a succession of assassinations and slaughters.

The Britons, or Cymri, occupied England and Wales, under the names of Logria and Cambria. And Ireland was peopled by a race who worshipped Baal, or the Sun, and who spoke the language of the Phœnicians and Carthaginians, the same that is spoken in the Highlands in Scotland, and there called Erse or Irish.

Even in these early ages, the Phœnicians and other Mediterranean traders visited Britain for tin, and this metal first gave them an importance to the ancient world. But it seems to be agreed, as a general fact, that when the Trojans were dispersed, on the taking of their city, they colonized in other places, and one Brutus, a Trojan Prince, landed with a fleet of adventurers at Totness, in Devonshire, about the year 1100 B. C. It is then alleged that he conquered the country, and left it to a dynasty, who governed it in different states till the Roman conquest. Shakspeare's *Lear* was one of these kings; Lud, who founded London, is said to be another; and, it is alleged that Brennus, who took and sacked Rome, at the head of a Gaulish army, in 385 B. C., was a British prince of this family.

The Irish claim descent from a colony from Caucasus and Iberia,

who first settled in Gallicia, and fled to Ireland, to escape conquest by Sesostris. Their language is Phœnician and Carthaginian, and they were worshippers of Baal.

When Henry VII. had availed himself of the unpopularity of Richard III. to usurp the sovereignty, he employed a commission of learned Cambrians to prove his grandfather's (Owen Tudor ap Meredith) pedigree. This they effected through 100 generations, up to Brute the Trojan King of Britain. First they traced him to Fychan, Chief-Justice, to Prince Lewelyn, and thence to Coel, King of Britain; whose line they traced to Rhegaw, daughter of Lear, and wife of Duke Henwin; and ten other steps carried Henry back to Brutus, whose name, say they, caused the country to be called Britain. His three sons—Leucrine had Loegria, now England; Kamber had Kambria, now Wales; and Albactanus had Albania, now Scotland. They also proved that, in the 30th degree, he was, on his mother's side, directly descended from Ruthven, or Vortigern.

The druids of Wales were the priests, administrators of justice, poets, and instructers of the people. The bards were the poets, and the most learned among the druids. The Romans and other intruders persecuted them, owing to their great influence over the people. Their colleges were called Bancor, and the youth of Gaul received education at them. They met annually, in a sort of parliament, at Abury, Carn Bre, Stanton-Drew or Druid, Lanidan, in Anglesey, &c.; and latterly at Caer Emrys, or Stonehenge, built by Ambrosius, about 460, on the site of a previous circle. They were fine poets and moralists, but their ideas of causation were superstitious, and they believed in elves, demons, charms, &c. Their moral maxims are equalled by none that ever were composed, and were expressed in triads for ease of memory. Their chief poets were Aneurin, Taliesin, and Merdynn, or Merlin; and many of their productions have high classical merit. The most noted bards were Plenydd, Alawn, and Gwron; and Britain was the source and head of the system. Its ultimate objects were to reform morals and customs, to secure peace, and to exalt virtue. They had three orders —presiding bards, orators or poets, and druids or instructers.

St. Pelagius was a Cambrian of the name of Morgan, and his heresy arose from his mixing some of the tenets of druidism with christianism.

Ban, in Welsh, signified *high*, and *cor*, a circle or choir. Hence, Stonehenge was called Cor Gawr by the Welsh, (or stone-hung, or hanging stones by the Saxons,) and Bancor, or Bangor, was the generic name for a principal church, and they had 8 or 9.

While the Romans governed, Latin was the language of the towns, of religion, law, and authority; and hence, when the Romans retired, it retained its ascendancy over the dialects of the nations abandoned.

It is curious that the Welsh Triads mention that Gavran went to sea in search of Gwerddonau Llion, the Green Islands of the sea, in accordance with a popular tradition that a Welsh Prince did sail on a voyage of discovery in an early age.

By the Briton's Triads, Caer-Icon-upon-Usk, Caer-Llundain in Lloeger, and Caer-evrawg in Deivr, (York), were then the principal cities. The last, they say, was founded by Evrawg Gadarn, the 6th King of Britain.

The Triads mention Gwidiva, the son of Don, as a great astrologer, such as Woden was of the Don, and this character is there assigned to that god of the Saxons. In another he is described as a man of illusion, and classed with Menew, the son of the three Cries, or Vedas, and with Rhudd Lwm, a giant.

The preservation and publication of the Cambrian records of British history was effected at the sole expense of Owen Jones, a plain furrier of Thames-street and edited by Dr. Owen Pugh.

In the sixth century the district of Gwaelod, between Merioneth and Cardiganshire, containing 16 towns, and the harbour of Gwythns was overwhelmed in a storm, owing to neglect in preserving the ancient embankments of stone, which had been

erected in consequence of former extensive encroachments on the same coast.

Armorica was granted, in 384, to Canon by Maximim, for aid against Gratianus. Cadwallader fled there, and afterwards to Rome, where he became a monk in 680.

The British lady Claudia, to whom Martial addressed two or three of his Epigrams, with others to Linus and Pudens, is supposed to be the very Claudia mentioned with Pudens and Linus, in Paul's second Epistle to Timothy. She is believed, by Cambrian writers, to be of the family of Caractacus, and, perhaps the first British Christian. In 51, Caractaeus was taken to Rome; in 62, Paul was at Rome; and, in 67, murdered by Nero; and, in 90, Martial died at 75. Her Cambrian name, as translated, would be Gladys Ruffyth, for Martial addresses her husband as Pudens, and Rufins, on their marriage; and he also addresses two or three of his epigrams to Linus, proving the connexion of the three, all of whom are mentioned by Paul as his friends. No proof more strong can be adduced than these, of the verity of Paul's letters, while the identification of this beautiful Briton, as an early Christian connected with Paul, is a most curious fact.

The Britons had annual meetings at Abury and Stonehenge, where laws were made, and justice administered, and heinous crimes punished, by burning in wicker-baskets. The Saxons had similar meetings of the *Michel-synoth*, or the *Michel-gemote*, or great council; and wittena-gemote, or meeting of wise men.

The name Caledonia is believed to be derived from Gael, or Gael-men, or Gadel-doine, corrupted by the Romans.

The Grampian Hills are famous for a battle between the Scots and Picts, under Galgacus and Agricola, in which the former were defeated with the loss of 100,000 men.

The spot in Anglesea, where Suetonius and his barbarous legions butchered the unoffending Druids, is still shown at a ferry called Porthamel, across the Menai Straits.

The success of Arthur, a British prince, against the Saxons in 12 pitch-battles, is recorded by Hennias, Gildas, and others; independent of Geoffry, of Monmouth, and the romance writers. He is also mentioned in Ossian, as an ally of Fingal. He flourished between 508 and 540. In 1189, Henry II. found his body, and that of his queen (Gueniver) at Glastonbury. He appeared to have been of large stature, and ten wounds were traced in his head, one of which seemed to have killed him.

The ancient Britons shaved the chin—the Saxons wore beards. The Normans shaved close. From 1200 to 1600, beards were generally worn through Europe. The Greek church clergy wear beards; and Romish clergy shave their chins, and part of their heads.

Hunting and fighting were the business of the Thanes and Ceorles. Every freeman was a soldier, and the working classes were slaves under the Saxons.

The Saxons were so called from their battle-axes, or *seaxis*.

The English peasantry were so commonly sold for slaves in Saxon and Norman times, that children were sold in Bristol-market, like cattle, for exportation. Many were sent to Ireland, and others to Scotland.

The British laws were translated into Saxon in 590. Alfred compiled the Saxon common law in 885. Edward the Confessor, promulgated his laws, 1065. Stephen's charter of general liberties, 1136. Henry the Second's confirmation, 1154 and 1175. Magna Charta, by John, 1215. Confirmations, by Henry III., in 1216, 1224, 1237, 1250, and 1264. Forest charter, 1225. By Edw. I., 1297 and 1299. By Edw. III., in 1345 and 1368.

Edmund Ironside and Canute settled their quarrels as all kings ought. They met to fight in single combat in the Isle of Alney, near Gloucester, and, after a few blows, they shook hands and agreed to divide the subject of contest, (the kingdom of England), Edmund taking the south, and Canute the north.

The cryer's "O yes! O yes!" is a corruption of the French "Oyez," listen. And the attendants on the King's *Buffet* are called Beef-eaters. So the White-point, Blanc-nez. is

called Blackness. And the gates of Boulogne are called the Bull and Mouth and the Bull and Gate; while the handsome savage, Belle Sauvage, is converted into the Bell and Savage; the French *Needle and Thread* is vulgarly called the Eagle and Child (L'aiguelle et fils.)

The different tribes of Saxon invaders divided England into seven distinct governments or kingdoms, called the *Heptarchy;* between which, wars prevailed for three centuries, till Egbert, of Wessex, in default of issue, united the whole in 827. These kingdoms were Kent, the South, the West, and the East Saxons, Northumbria, the East Angles, and Mercia. Kent, the first, was established by Hengist in 455; and Mercia, the seventh, and the Midland Counties, about 585. Hence, the heptarchy lasted about 243 years, and the kingdom of Kent 372 years.

Previous to the conquest, the crown of England had long been held by a priest-ridden, superstitious, weak prince, Edward the Confessor; brother and successor of Edmund Ironside. Edward had no children; and Edward, a son of Edmund, his nephew and heir-apparent, died in his old age, leaving a son Edgar, under age; while two turbulent sons of his sisters, Harold and Tosti, were all-powerful. He made a will in favour of William, Duke of Normandy, whom he had entertained a few years before at his court. Harold setting aside Edgar, Edmund's son, seized the crown, and hence a division in the country facilitated the conquest by William. Henry I., grandson of William, afterwards married a granddaughter of the superseded Edgar, for the purpose of reconciling claims.

William the Conqueror was seventh in descent from Rollo, the Danish pirate.

The Bayeux tapestry, wrought by Matilda, wife of William the First, representing the circumstances attending the invasion of England, is 214 feet long, and 19 inches wide, divided into compartments, representing the train of events from the signature of the will of the besotted Confessor, down to the crowning of William. This very curious relic is now preserved in the Royal Library, at Paris.

Kings and Queens since the Conquest

Kings and Queens.	*Born*	*Began their Reign.*	*Reigned.* Y.	M.	D.	*Age.*
William I.	1027	1066 Oct. 14	20	10	26	60
Will. Rufus	1057	1087 Sept. 9	12	10	24	43
Henry I.	1068	1100 Aug. 2	35	3	29	77
Stephen	1105	1135 Dec. 1	18	10	24	49
Henry II.	1133	1154 Oct. 25	34	8	11	55
Richard I.	1156	1189 July 6	9	0	0	43
John	1165	1199 April 6	17	6	13	50
Henry III.	1207	1216 Oct. 19	56	0	28	65
Edward I.	1239	1272 Nov. 16	34	7	21	67
Edward II.	1284	1307 July 7	19	6	18	43
Edw. III.	1312	1327 Jan. 25	50	4	27	65
Richard II.	1366	1377 June 21	22	3	8	33
Henry IV.	1367	1399 Sep. 29	13	5	20	46
Henry V.	1389	1413 Mar. 20	9	5	11	33
Henry VI.	1421	1422 Aug. 31	38	6	4	49
Edward IV.	1442	1461 Mar. 4	22	1	5	41
Edward V.	1471	1483 April 9	0	2	15	12
Richard III.	1443	1483 June 22	2	2	0	42
Henry VII.	1456	1485 Aug. 22	23	8	0	52
Hen. VIII.	1492	1509 Apr. 22	37	9	6	55
Edward VI.	1537	1547 Jan. 28	6	5	8	15
Mary I.	1516	1553 July 6	5	4	11	42
Elizabeth	1533	1558 Nov. 17	44	4	7	69
James I.	1566	1603 Mar. 24	22	0	3	58
Charles I.	1600	1625 Mar. 27	23	10	3	48
Charles II.	1630	1649 Jan. 30	36	0	7	54
James II.	1633	1685 Feb. 6	4	0	7	67
Mary II.	1662	1689 Feb. 13	5	10	15	32
William III.	1650	1689 Feb. 13	13	0	23	52
Anne	1665	1702 Mar. 8	12	4	21	49
George I.	1660	1714 Aug. 1	12	10	10	67
George II.	1683	1727 June 11	33	4	14	77
George III.	1738	1760 Oct. 25	59	3	4	82
George IV.	1762	1820 Jan. 29	10	4	28	68
William IV.	1764	1830 June 26				

The Normans, or north-men, from whom our English nobility claim descent, were northern pirates, who, about the middle of the 9th century, infested the coasts of England and the English channel, and at length made landing in Neustria, and wasted the country, three times besieging Paris. At length, Charles the Simple, in 912, entered into a treaty with Rollo, their chief, giving him his daughter in marriage, and settling upon him the province then first called Normandy, with the title of duke, requiring him to do homage for it. Rollo was then baptized by the name of Robert, but known to the Normans as Haro, or Ha-Row. He was succeeded by his son, Richard I.; he by Richard II.; he by Robert II., who, by Herleve, or Herlot, a mistress, had the bastard William, who conquered England.

During the Roman conquests, Spaniards and Italianians fled to Ireland, and Gauls and Belgians to

Britain; hence, there was always a foreign mixture with the natives, and, to this asylum, afforded to fugitives, is to be ascribed the subsequent Roman invasion.

The Doomsday-book, or register of the lands of the kingdom, was made by five justices, between 1081 and 1086, and is still preserved in the Exchequer.

Our ancient kings used to keep *jouglers*, or minstrels and then jesters, under the Tudors; and James I. converted them into poet-laureates.

Magna Charta provides that fines or amercements shall never destroy a man, and, therefore, all such are unlawful. It saves a freeholder's estate, a merchant's merchandise, a scholar's books, a workman's tools, &c.

By Magna Charta 10*d*. was fixed as the price per day of a cart with two horses, and 1*s*. 2*d*. with three.

Parliaments were fixed by the 14th chapter of Magna Charta, by a pledge to summon archbishops, bishops, abbots, earls, and great barons, and, by the sheriffs, all who held a fief; after 40 days' notice, which was to express the cause; and, by chapter 13, it is provided that no scutage or aid shall be imposed, unless by this common council of the kingdom.

The barons, or tenants in chief, or freeholders, by doomsday-book, were 700; but, being split into small parts, were greater and lesser, all of whom were entitled to sit in parliament: but, in 1307, the latter, or lesser barons, were allowed to choose two representatives; hence called knights of the shire.

Common law is the unwritten law of the country, founded on custom, usage, and maxims derived from common sense; but is varied by written, printed, or statute law, made for the purpose of correcting and defining common law.

Adrian IV. permitted Henry II. to invade Ireland, on condition that he compelled every Irish family to pay a carolus to the Holy See, and held it as a fief of the church.

England was under an interdict from 1207 to 1214. Archbishop Langton absolved King John, on promise that he should restore the charter of Henry I.; and John afterwards yielded his kingdom twice to the Pope. In 1215, the barons took the field at Stamford, under Robert Fitzwalter, Baron of Dunmow, and all deserting John, he met them on June 15, at Runnemede, a meadow between Staines and Windsor, when the great seal was affixed to the charter, and 25 barons were elected to secure its fulfilment, and they were put in possession of the Tower of London. Twelve knights were also appointed to rectify the forest laws. John was so indignant, that he died in October, at Newark, as was said by poison, or of a broken-heart. His son, Henry III., afterwards confirmed them in 1236 and in 1253, in Westminster-hall, with great solemnity. Edward I. did the same, before he could obtain supplies or service. There were, therefore, five charters—one of John, three of Henry, and one of Edward I., the same in spirit, but slightly varied in expression.

No accusation of crime can be lawfully made by the laws of England, except before a grand jury, sworn to secrecy; and 12 must decide that it is true, before the party can be required to answer.

Verdicts of juries must be unanimous, that every one may be responsible to his own conscience and to the parties, and that the decision may be considered as a certainty, not probability.

No English judge can pass a sentence greater than the law prescribes; but he may diminish the extreme severity of the law, as the case requires.

Proof of guilt lies with the accuser, and the accused is not expected to prove a negative. Proof also should be positive, and not presumptive. All doubts are construed favourably to the accused; and the opinions of a judge ought to have no weight with a jury every one of whom ought to think for himself and decide for himself.

Petty juries are *special* for civil cases or for trials of treason, or political offences, and consist of freeholders or leaseholders of certain

estate; or *commons* of smaller estate, for civil or criminal cases. Their verdict should be matter of *certainty*, not probability or possibility; and, of this certainty, every one of the twelve is bound to be satisfied before he consents to the verdict, which is the sole and entire affair of the jury, whatever may be the declared opinion or apparent wishes of the judge or court. All proof of guilt rests with the prosecution; and guilt is not to be inferred if innocency is not proved, for that is often impossible, and never required; while it is of far less consequence that even 99 guilty escape the vengeance of the law, than that one innocent man should suffer by a hasty and erroneous verdict; for, after the verdict of the jury, the law assumes the guilt as matter of certainty, and does not libel the jury by a sentence qualified by any doubt of guilt. The jury are also judges of the criminal intention, as well as of the fact; and they must be satisfied with proof of both before they assent to a verdict, which decides both on the fact and the criminal purpose.

Prothonotories are officers for recording the proceedings or decisions of courts of law.

A solicitor is properly only an attorney, who conducts suits in equity.

The *Posse Commitatus* is the whole male population, called out by the sheriff or two justices; and all not attending are liable to be imprisoned.

The court of *Picpoudre* is formed at all fairs, by the steward, for summary redress of wrongs in the fair.

The king's tribute, or relief, by William I., was, for an earl, 8 war-horses, saddled and bridled, 4 hunters, and 1 palfrey, with armour and weapons. A baron paid half; a vavasor, or squire, his best horse and complete armour; a farmer, his best beast; and tenants, a year's rent.

Magna Charta was a charter for the nobles, extorted from King John; and extended to the people by the petition of right conceded by Charles I., and by the bill of rights, 1688.

The original of Magna Charta, preserved in the British Museum, is 14½ inches broad, and 20½ long. Another copy is 17 by 21.

Fee-farm-rent is a composition paid by a whole borough, or town, to the lord, in lieu of individual claims; and this arrangement produced free boroughs and their representation. Middlesex pays to this day, by the sheriffs, a fee-farm-rent of 300*l.* per annum.

A Heriot comes from the Saxon H. regeat, tribute of weapons.

Titles, customs, &c. in law, are immemorial, even before Edward II., or 1340.

By the custom of gavel-kind, in parts of Kent, an estate is divided among all the sons; and that of an intestate brother, among his brothers. It is disliked by the aristocracy, but much approved by moralists and publicists.

From 1070 till 1362, the business and pleadings of the law courts were in Norman French. The pleas were then in English, and the enrolments in Latin. But, in the age of Cromwell, both were in English; and it was so settled in 1730.

A Feod, or feud, was a grant of land to a vassal, on condition to the lord, as for military service, &c. This was the feudal system.

The King's Title.—Henry the Eighth was the first King of England who assumed the title of Majesty. Before his reign, the Sovereigns were usually addressed "My Liege," and "Your Grace." The latter epithet was originally conferred on Henry the Fourth; "Excellent Grace" was given to Henry the Sixth; "Most High and Mighty Prince," to Edward the Fourth; "Highness" to Henry the Seventh; which last expression, and sometimes "Grace," was used to Henry the Eighth. About the end of this reign, all titles were absorbed by that of "Majesty," with which Francis the First addressed him at their interview in 1520. James the First coupled this title to the present "Sacred," or "Most Excellent Majesty."

Before the union of the Crowns, Britain alone was in general use, in the style of our Sovereigns, to signify England and Wales. Alfred, however, was called "Governor of the Christians of Britain;" Edgar, "Mo-

narch of Britain;" Henry the Second, "King of Britain;" and John, "Rex Britanniarum, King of the Britons."

The royal style settled on the 5th of November, 1800, on the union with Ireland, which was to commence from the first of January, 1801, runs thus:—"George the Third, by the Grace of God, of the United Kingdom of Great Britain and Ireland, King, Defender of the Faith, and the United Church of England and Ireland, on Earth, the Supreme Head."

In Latin, "Georgius Tertius Dei Gratia Britanniarum Rex," &c.; the word *Britanniarum*, which was first introduced on this occasion, being regarded as expressive, under one term, the United Kingdoms of England, Scotland, and Ireland.

Prince is evidently derived from the Latin word *Princeps*, or Chief.

Duke.—This is a title of honour, or nobility, next below a Prince. It is a Roman dignity; and the first Dukes (*Duces*, leaders) were commanders of armies.—Under the latter Emperors, the Governors of provinces were styled *Duces*. When the Goths and Vandals overran the provinces of the Western Empire, they abolished the Roman dignities; but the Franks and others divided all Gaul into Duchies and Counties, and gave the name of Dukes (*Duces*) or Counts (*Comites*), as the case might be, to them respectively.

In England, during the times of the Saxons, the officers and commanders of armies were called Dukes, after the manner of the Romans. After the Conqueror's time, the title lay dormant till the reign of Edward the Third, who created his son Edward (first called the Black Prince) Duke of Cornwall.

Marquis.—(*Marquis*, Fr.; *Marques*, Sp.; *Marchese*, Ital.; *Marggraff*, Sax.; *Markgrave*, Belg.)—A title of honour next below that of Duke, and said to be derived from the Harcommanni, an ancient people who inhabited the *marches* of Brandenburg. It was introduced into England by Richard the Second, who created Robert Vere (Earl of Oxford) Marquis of Dublin. The title is originally French; the Romans were unacquainted with it. Marquises were formerly Governors of frontier towns, or provinces, called *Marches*.

Earl.—This is an English title of nobility next below a Marquis, and above a Viscount. Earls were anciently attendants or associates of the King in his Council and warlike expeditions; as *Comites* (Counts) were of the Magistrates of Rome. Hence Earls are called in Latin *Comites*, and in French *Comtes*. The Germans call them *Graves*, as *Margrave*, &c.; the Saxons *Eorldermen;* the Danes *Eorlas*, and the English *Earls*. William the Norman first made the title hereditary.

Viscount.—This title is used for an order, or dignity, next below an Earl. It was an ancient title as an office, but is a modern one as a dignity, being never mentioned as such before the reign of Henry the Sixth. It is supposed to have been introduced by the Normans.

Baron is derived from the Latin *Baro*, which was used in the purer age of that language for *Vir*, a valiant man. Hence those placed next the King in battle were called *Barones*, as being the bravest of the army; and as Princes frequently rewarded the bravery and fidelity of those about them, the word was used for any noble person who held a fee immediately of the King. Baron signifies in England a Lord, or Peer of the lowest class; or a degree of nobility, next below that of a Viscount, and above that of a Baronet. Barons are Lords of Parliament, and Peers of the Realm.

Lord.—This is a general name for a Peer of England, which is also applied to several offices, as Lord Chancellor, Lord Mayor, &c. It is a Saxon word, but abreviated from two syllables into one; for it was originally *Hlaford*, which, by dropping the aspirate, became *Laford*, and afterwards, by contraction, *Lord*.—"The etymology of this word," says a writer, "is worth observing, for it was composed of *Hlaf*, a loaf of bread, and *Ford*, to give or afford; so that *Hlaford*, now *Lord*, implies a giver of bread; because in those ages, such great men kept extraordinary houses, and fed the poor; for

which reason they were called *givers of bread.*"

Lady.—In former days, when men of large fortune lived constantly at their mansion, or manor-houses, the good ladies, their wives, as constantly served out to the poor weekly, with their own hands, a certain quantity of bread, and were, therefore, called *Lef-days*—two Saxon words, signifying *Bread-giver.* As the practice became less frequent, the words were soon corrupted; and the mistress of the manor is called, to this day, the *Lady*, i. e. *Lef-day.* As a title of honour, it properly belongs only to the daughters of Earls, and of all higher rank; but custom has made it a term of complaisance for the wives of knights, and all women of eminence or gentility.

Edward II. was murdered in a solitary chamber, now shown at Berkeley castle, with the bed and pillows, and marks of blood on the floor.

Richard II. was killed in a room in Pontrefact castle, now in ruins, but nearly perfect on three sides.

The bedstead and travelling treasury of Richard III. is still shown at Rothley, near Leicester. It was hollow, and full of gold pieces, not discovered till 120 years afterwards. His stone-coffin, and the skull of Wolsey, were for years in possession of Sir R. Phillips.

Edward I. first banished the Jews from England; but Cromwell permitted their return. As they could hold no property in land, in any Christian country, they were the universal exchange brokers, and dealers in money and government funds. They enable all Christian governments to borrow and to carry on wars. The Goldsmidts were the agents of the Pitt administration; and Rothschild, the modern Jew, is necessary to all the governments of Europe, conferring on each, on due security, the monetary strength of the whole.

Magna Charta demanded witnesses before trial; and, since Edward III., the fictitious names of *John Doe* and *Richard Roe* are put into writs, as pretended witnesses!

The power which the House of Commons possesses of granting or withholding subsidies or grants to the crown or executive power—and the indispensable assent of each branch of the British legislature in the enactment of law, which govern the courts of law and bind the people—confer an influence on that body which obliges the crown to compromise with the leaders or majorities, by conferring on them the ministerial direction of the government. Hence, as these parties vacillate, changes of administration take place. Again, as the restoration in 1660 was the act of the people or their leaders, and, as the revolution in 1688 was also the act of the people or their leaders; so the crown, by policy and habit, yields to this influence, and changes of administration are evidences of the fluctuating ascendancy of parties. Since those periods, therefore, the changes have been numerous. The two parties in the aristocracy are the *Whig* and *Tory*—those who would curb the power of the crown, and those who would curb the power of the people. But among the people there are four parties, those who follow the aristocracy as Whig or Tory; those who seek to increase the influence of the people in parliament, and render the House of Commons a real representation, who are called *reformers;* and those who are *republicans.*

The first summonses for calling a parliament, under the Normans, were in the 49th of Henry II.

Chivalry appears to have emanated from the combats in ampitheatres, instituted by the semi-barbarous Romans. With greater propriety, men fought instead of animals; the combats were a species of boxing-matches, in which the parties were covered with armour, and provided with spears, swords, battle-axes, and maces. Tilts, justs, and tournaments occurred on the return of the crusaders from the holy wars. For 3 or 400 years they were the chief amusements of courts, and the successful combatants acquired celebrity, knighthood, and the favour of the ladies; their seconds, or bottle-holders, they called 'squires. When publick combats declined, successful knights travelled in quest of adventures, to correct injustice, and fight

in the cause of the ladies; and the consequent follies gave rise to the novel of Don Quixote.

The revenues of the 193 abbeys, dissolved at the reformation or general plunder, were 2,853,000*l.*, or 15,000*l.* each, on the average. The lands given to court favourites would, at this time, pay half the interest of the publick debt.

At the time of the violent dissolution of the religious houses by Henry VIII., estates left to them, *in trust*, by pious persons, for the poor and sundry charitable purposes, worth a million per annum, and now worth 20 millions, were seized by the crown and granted to the servile parliament, nobility, and courtiers, who, since that time, have continued to enjoy the same.

17,000 acres were added to the New Forest in the reign of William I.

The tyrant, William I., to preserve his game, made it forfeiture of property, and imprisonment to disable a wild beast; and loss of eyes for a stag, buck, or boar. Of these laws, the clergy were zealous promoters; and they protested against ameliorations under Henry III.

The curfew was a law only till the accession of Henry I. Since that time, the 8 o'clock evening-bell has been a custom only. Henry, at the same time, voluntarily proclaimed the first charter of liberties, which was confirmed by Stephen and Henry II., but neglected till extorted from John.

The title of Duke of Clarence is derived from the earldom of Clare, in Suffolk.

The title of Duke of Albemarle is derived from the earldom of Aumerle, or Albemarle, in Upper Normandy.

Fair Rosamond, the favourite of Henry II., had a son by him, William Longspee, earl of Salisbury, who was a constant adherent of his brother, the tyrant John, and a man of great renown in the events of that turbulent age. He died in 1226; but his widow, not less remarkable for her personal deeds, lived till 1263, and died Abbess of Lacock.

From the 12th to the 15th century, the barons of England were so independent of the sovereign, that they often made formal wars on each other; they tried causes, and administered justice in the Barons' Court, in the great hall of their castles, and had prisons within them; and they even coined money. The Earl of Warrene held numerous manors in twelve different counties; and the sixth Earl of Douglas used to be attended by 2000 horse. Barons at first sat in parliament to perform a duty as possessors of land belonging to the king; but Richard II. summoned them by writ, without reference to their lands; and made peers by letters patent, a practice which continues to this day.

20*l.* a year was the income of a knight; a baron's, 266*l.* 13*s.* 4*d.*; and, an earl's, 400*l.*, in the 13th century. Their tribute, or relief, was a fourth.

Knights baronets, with male descent, was a contrivance of Cecil, Earl of Salisbury, to raise money for King James to reduce and civilize Ulster. The party applying were required to have 1000*l.* per annum, to be of good birth, and to raise 30 foot-soldiers, and maintain them in Ulster for three years; or, as an equivalent, pay 1000*l.* One hundred soon obtained the title: and the first who applied and got it was Sir Nicholas Bacon, of Redgrave, Suffolk. This title was extended to Scotland, for the purpose of settling Nova Scotia; and Sir Robert Gordone, of Gordon-stone, was the first baronet, in 1625; and these Scotch baronets are now called Baronets of Nova Scotia.

Knights bannerets led their vassals to battle under their own banner; but knights bachelors were those who were commanded by a superiour. The former were expected to bring 100 men into the field.

Esquires were, among the Greeks and Romans, shield-bearers and armour-bearers, and called armiger and scutigerulus, from which last comes the word esquire. A British queen is recorded as marrying the *armigerum*, or esquire of her husband. Under Charlemagne they were called *Schildknappa;* then by the French, *Ecuyer;* Anglicized, *Esquire;* and now conferred on all who have a good coat or a clean shirt.

Bachelor was a title of rank in the middle ages, between an esquire and knight, from *Bas Chevalier*.

Villain, in ancient times meant a country labourer.

A boor, in modern language, signifies any unlettered vulgar person; but under the Norman princes, this class, called villains, was divided into vassal boors and free boors; those who were sold with the land, and those who were free, to choose an employer. To this day the distinction prevails in some countries, and particularly in Russia, where the vassal-boors are divided into classes, as boors belonging to the sovereign; mining boors, who are sold with the property; and private boors, who belong to the nobility, and perform the labour on their estates; they amount to 12 or 15 millions.

The three bastard sons of John of Gaunt, by Katharine Swinford, were called Beaufort, from his castle in France, and made Dukes of Somerset and Exeter, and Marquisses and Earls of Dorset.

In 1290, the royal family of Scotland became extinct, and the rights of several competitors were submitted to the arbitration of Edward I., he made his award in favour of John Baliol. The Scots were dissatisfied, and preferred successively William Wallace and Robert Bruce, which led to an invasion and conquest of Scotland by Edward. Fresh disturbances in Scotland led him to assemble an army at Carlisle, where he died, in 1307; but, in 1314, the battle of Bannockburn terminated the war.

The body of Thomas Beaufort, Duke of Exeter, who died in 1427, was found, in 1772, in the ruins of the Abbey of St. Edmondsbury, wrapped in lead. The lead was opened, and the body found fresh. Some brutal workmen stole away the lead, and then threw the corpse into a hole, which they filled up.

Agincourt is a village in Picardy, where Henry V. was intercepted with about 20,000 men, by 100,000 under the Duc d'Alençon, Oct. 25, 1415. The French were defeated with the loss of 10,000 slain, and 14,000 made prisoners, whom Henry barbarously murdered under a false alarm.

The battle of Bannockburn was fought on the 25th of June, 1314, between the Scots, under Robert Bruce, and the English, under the young King, Edward II. The English crossed a rivulet to the attack, but Bruce having dug pits, which he had covered, they fell into them, and were thrown into confusion. The route was complete, and 50,000 English were killed or taken prisoners.

The Cinque or Five Ports of Dover, Sandwich, Romney, Winchelsea, and Rye, as the nearest points to France, were anciently considered as the keys of the kingdom, and therefore put under a Lord Warden.

Saddles were not used till the third century.

Estrays are animals found at large, without owner; and waifs are stolen property, left by felons; both belong to the lord of the manor.

The Essoign-day is the first day of every term; but usage concedes three days as essoign or excuse.

Quit-rent is so called from *white*-rent, being to be paid in silver; which, in other rents, were paid in kind.

The Spanish Armada, for invading England in 1588, consisted of 130 ships, of which 100 were larger than any before built. It conveyed 19,295 soldiers, 10,500 seamen, and 2630 brass cannon. They were to convey an army of 34,000 men from the Scheldt, in flat-bottom boats. The English opposing fleet, of smaller vessels, was about 101 ships. The Armada returned by the Shetland Islands, and not more than half reached the Spanish ports.

The right of Gleaning is founded on the express injunction of the Mosaic law, which Jesus declared he came to fulfil and enforce.

Racks, for extorting confessions, were made of pulleys, cords, thumb-screws, &c., by which the parties were made to confess whatever was wished.

The writs issued in chancery are those which relate to the crown, which used to be kept in a little *bag*; and those relative to the subject kept in a *hamper*; and hence the hanaper-office and petty-bag-office.

A pardon cannot follow an im-

peachment by the House of Commons.

The Guelphs succeeded to the English throne by act of parliament, as Protestant descendants of Elizabeth, the daughter of James I. married to Frederic Elector Palatine, whose daughter Sophia married Ernest Augustus, Bishop of Osnaburgh, afterwards Duke of Hanover, who, in 1692, was created ninth Elector of the German Empire.

In passing British laws (if private) a petition for leave is presented, and referred to a committee for leave to bring in the bill: if publick, the bill is moved without leave; but, in the lords, it is referred to two judges to report. After the second reading it goes before a committee, select, or of the whole house. It is then read a third time, and passed; first in one house and then in the other, when the royal assent makes it law.

Bail is security to appear and answer to some accusation; and, by an abuse of law, is in England exacted for claims of debt, but restricted to sums above 25*l*. The vexations of the system render it a source of intolerable oppression. The law refuses bail on sworn charges for treason, murder, manslaughter, felony, and outlawry. Excessive bail is forbidden.

No person can be arrested in a fair except for debts contracted there, or promised there to be paid. This is ancient law, opposed to the turpitude of modern legislation, and the villany of legal practice unrestrained by benevolent legislation.

In England, a male of 12 may take the oath of allegiance; at 14, may consent to marriage, or choose a guardian, or make a will; at 17, may be an executor; and, at 21, is of age. A female, at 12, may consent to a marriage; at 14, may choose a guardian; at 17, may be an executrix; and, at 21, is of age.

By the statutes of the 9th and 13th of William III., it is enacted, that submissions to arbitration may be a rule of any of the courts of record, and equivalent in force to the decision of a jury. These statutes are, however, unavailing, owing to barristers being often made arbiters, by which a decision according to law, and not according to equity, is made. —*Vide Gazelee.*

The first administration of Charles II. was a conciliating mixture of respectable republicans, and his personal adherents while abroad, under Clarendon. It lasted till 1663.

The second was formed under the influence of the Duke of York, a zealous Papist, and lasted till 1670.

The third, called the *Cabal*, from the initials of their names—Clifford, Arlington, Buckingham, Ashley, and Lauderdale. Publick crime and unprincipled policy was now at its height, and no man's life or honour was secure.

King James, in 1685, continued, with some additions, the administration of his brother.

King William, in 1689, established the first decided Whig administration. In 1690, he admitted Tories; and, in 1693, the Whigs were restored.

Queen Anne, in 1702, chose a Whig Administration till 1710, consisting of Lord Godolphin, Lord Somers, the Duke of Marlborough, &c. The Tories succeeded, under Harley, Bolingbroke, and the Clarendons.

George I., in 1714, chose a Whig administration; and the Tories were prosecuted.

George II. continued the Whigs in power; but a reforming party, led by Windham, Shippen, Hungerford, and Pitt, now appeared in parliament. At this time, Whigs and Tories were considered as alienated from the interests of the people. In 1739, the Walpole administration yielded to a more popular Whig party; and, in 1744, other Whigs came into power.

In 1754, a mixed administration was formed under the Duke of Newcastle; but, in 1756, a change took place in favour of the Whigs, and the first Pitt became minister.

George III., in 1760, ejected the Whigs and formed a Tory administration under Bute and Jenkinson.

In 1763, Grenville succeeded Bute; and his prosecutions of Wilkes, and plans of taxing America, changed the fortunes of the empire.

In 1765, the Whigs came into power under the Marquis of Rock-

ingham; and, in 1766, a change of men took place, and Mr. Pitt returned to office.

In 1771, the Tory administration of Lord North was formed, and continued through the American war, till 1782, when the Whigs, under the Marquis of Rockingham, came into power. The death of the marquis occasioned a division of the Whigs, and a coalition of Mr. Fox, at the head of one division, with Lord North, at the head of the Tories, in 1783. Late in that year, the administration of the second Pitt was formed, and it continued on Tory principles till the French war in 1801.

In 1801, another Tory administration was formed under Addington.

In 1804, the Pitt administration was restored. Early in 1806 Pitt died, and a Whig administration succeeded under Mr. Fox; but he dying in September, a Tory administration, under Perceval and Eldon, succeeded in the February following. Perceval was shot in 1812; but the same administration was continued by George IV., under Liverpool, till Liverpool's death, in 1827.

A mixed administration succeeded of Whigs and Tories under Canning, who died in the same year; and was succeeded by Lord Goderich and a Tory party, and replaced, in 1828, by the Duke of Wellington, who, in 1830 was succeeded by Earl Grey and the Whigs.

The Act of Union with Scotland was the 5th of Anne, cap. 8, and consisted of 25 articles, one of which provides, that the land-tax of Scotland shall be but in a fixed proportion to that of England.

The battle of Culloden, in which the Guelphs, under William Duke of Cumberland, defeated the last of the Stuarts, took place in April, 1745, near Inverness. Nearly 3000 of the Scots were killed on the field, or barbarously slaughtered afterwards in the pursuit; while the executioner made terrible examples of many others. Prince Charles, after wandering as a fugitive, and experiencing many romantick adventures, escaped to France, and died at Rome, in 1788.

The *Juges de Paix*, or Justices of the Peace, in France, amount to several thousand, and are chiefly lawyers, with small salaries. They decide petty cases of property, besides keeping the peace, and, in other respects, their functions resemble those of English Justices of the Peace, with this incalculable and exemplary advantage, that no action can be maintained in any court, till the *Juge de Paix* has certified that he has heard the parties, and finds it impossible to reconcile the difference.

By the salique law in France, no female can succeed to the throne.

The word *writ* is derived from the Saxon, *writan*, to write.

De facto is applied to actual possession, and *de jure*, to right.

A Hindoo jury, agreeable to ancient custom, consists of five persons, chosen from among the elders; two by the plaintiff, two by the defendant, and the fifth by the administrator of justice.

Twelve persons, assembled for an unlawful purpose, constitute a riotous assembly.

The number of barristers, in 1831, was 1132, whose fees constituted one fourth of the whole expenses of lawsuits; conveyancers and pleaders, 132; London attorneys, 9342; country attorneys, 2742; total number of lawyers in England and Wales, 13,348, being 453 more than there were on the 1st January, 1830. For the 10 years ending 1830, the attorneys paid, in duties on articles of clerkship, admissions, and yearly certificates, nearly 100,000*l.* sterling.

The wall of Adrian and Severus, built to prevent the eruptions of the Scots and Picts, extended from the Tyne to Solway frith, and was 80 miles long, 12 feet high, and 8 in thickness, with watch-towers.

The Romans divided Britain into four provinces:—

1. Wales, called *Britannia*.

2. South of the Thames, called *Britannia prima*.

3. The counties from the Thames to the parallel of the Humber and Mersey, called *Flavia Cæsariensis*. And,

4. The Northern Counties, called *Maxima Cæsariensis*.

They also occupied Scotland to

the parallel of the Forth and Clyde, called Valentia. And further north, in the eastern half, were the *Picti;* and, in the western, the *Scoti;* who were identified with Hibernia or Scotia.

In 207, Severus kept the imperial court at *Eboracum*, now York; and, in 312, the Emperor Constantine was born at York, his mother (Helena) being understood to be his father's mistress, and an inn-keeper's daughter at Colchester; for his father married another in her lifetime.

In religion the Britons were Deists, or disciples of the druids; the Romans introduced the gods of the Grecian Mythology; the Saxons were idolaters, and called the days of the week after the objects and gods of their worship. In 597, Pope Gregory sent Augustine to preach christianity in the south, and Paulinus in the north. It spread till Adelfrid, King of Deiri, or Northumbria, which included *Maxima Cæsariensis,* sustained the Saxon religion, and made conquests on all sides, slaying no less than 1200 monks in a battle near Chester. Being afterwards defeated and succeeded by Edwin, he became a convert to Paulinus; and, after struggles for a century, christianity prevailed.

The Trojan princes were contemporaneous with the British princes about 1000 years. The Romans governed 400; the Saxons about 600; and the Norman succession about 765 years to this time.

Wales continued a separate sovereignty till Edward I., in 1283; and Scotland till its king succeeded of right to both kingdoms in 1603. Ireland was invaded by Henry II. in 1172, but never quite conquered till the time of Cromwell. The Legislatures of England and Scotland, were united in 1706; and, of Great Britain and Ireland, in 1800.

The wars in France, in which England was involved for nearly two centuries, arose from the Dukes of Normandy being Kings of England. They held Normandy under fief granted to Rollo, and were too powerful for their lord. Intermarrying too in the French court, they acquired titles to the French crown, which France opposed; and, hence, wars to drive them out of Normandy on the French side, and wars of encroachment on the other side. The English princes gained bloody victories at Cressy, Poictiers, and Agincourt; but they were finally driven out of France in the reign of Henry VI., and lost Calais, by surprise, in the reign of Mary. It was to the English people a fortunate loss; but the rival policy of the two governments have, even since then, caused half as many years of war as of peace.

Wat Tyler's rebellion took place in 1389, and Jack Cade's in 1450. Both began in Kent, were very fatal to London, and terminated by the death of their leaders. One paved the way for the dethronement of Richard II., by his cousin, Henry Duke of Lancaster; and the other to the destruction of Henry VI., and the House of Lancaster, or the Red Roses, by their cousins of the House of York, or the White Roses. The first battle was at St. Albans, in 1455, and the last at Tewkesbury, in 1471; and, in the 16 years, above 30 great battles were fought, the country half depopulated, and nearly the whole of the nobility exterminated.

In this war the nobles, to seduce their vassals to join their standards, emancipated them; and, in 30 years after, the statute of alienations enabled the commoners to purchase land, and gave a new character to society.

The wars of the White and Red Roses arose thus. Edward III. had three sons, the Prince of Wales, the Duke of York, and the Duke of Lancaster; each of whom had sons. The Prince of Wales died before him; and he was succeeded, of right, by his minor grandson, Richard II., who became unpopular, and banished his cousin, Henry of Lancaster. Henry returned, headed the malcontents, who, on dethroning Richard, made Henry king, in prejudice of the Duke of York and his family, who yielded to the succession of Henry V. and VI. The latter married Margaret of Anjou, who quarrelled with the then Duke of York, grandson of Edward III.; a contest ensued, and the duke, and one of his sons, were killed at Wakefield. His sons fled, found partizans, an

the war continued till the Lancastrians were destroyed; and the brothers, Edward IV. and Richard III., successively filled the throne. Henry VII., who killed Richard in 1485, was great grandson to Lionel, a fourth son of Edward III.; and his mother was widow of Henry V., and had him by a second husband, of the name of Tudor; but, to remove doubts, he married the daughter of Edward IV., and, though he behaved very ill to her, had by her two sons, Arthur, who died before him, and Henry the Eighth. Henry had also a daughter Margaret, who was married to the King of Scotland; and, on his grand-children dying without issue, her descendant, James VI. of Scotland, succeeded to the crown as James I. of England; and, from a daughter of his, there descended the House of Hanover.

The male line of the Stuarts in the fourth descent were set aside by act of parliament at the revolution, owing to their being Catholicks. But, in 1715 and 1745, the son and grandson of James II. made vigorous efforts to recover their hereditary rights. In those years they landed in Scotland, and marched into England; but the first was defeated near Preston, and the second, after retreating from Derby, was defeated at Culloden, on the 16th of April, 1746. Both victories were followed by numerous vindictive executions, and the victory at Culloden by a military butchery little creditable to the powers of the time. This male line is now extinct.

The first coinage in England was under the Romans, at *Camulodunum*, or Colchester; and forty varieties of it are to be found in cabinets. The Britons had no coinage, and, as a substitute for gross barter, paid metal by weight.

In 628, the first stone church was built by Edwin, King of Northumbria, at York, which soon after was covered with lead, and then glazed. Till then, houses and buildings were of wood, or plaster or mud. The building of Wearmouth Abbey soon after led to the bringing of glass-makers from the continent.

Rents, down to the conquest, and chiefly afterwards, were paid in kind,—as in honey, bread, ale, oxen, sheep, poultry, cheese, butter, and fish, equal to a 15th or 20th of the produce.

Edwin, King of Northumbria, in the 7th century was the precursor of Alfred in the 9th, and an exemplary improver and ameliorator. His coinage is still in existence; and, though he improved Yorkshire, yet, so late as the reign of Edward III., there was no recorded town in the now saturated county of Lancashire.

The pound sterling was, in Saxon times, a pound troy of silver, and a shilling its twentieth, consequently above three times as large as at present.

Wakes and annual feasts were established by the Saxons, in celebration of the Saint's day of their parish church; and market-towns were then designated as such.

Originally juries were 12 men, who, on oath, certified their belief of innocence. Then, in formal trials, they were the persons present; and, in time, fixed at 12.

After the battle of Hastings, a list was taken of William's chiefs, amounting to 629, and called the Battle Roll; among whom the lands and distinctions of the followers of Harold were distributed. The northern counties held out; and York was defended, but taken, its defenders put to death, and the whole country devastated, many ancient towns being utterly destroyed.

The division of the kingdom into counties, hundreds, and tithings, is ascribed to Alfred; but there is evidence that some counties bore their names, and had those divisions 150 years earlier.

The tithing meant every 10 families; and the hundred 10 tithings, governed by a head constable or bailiff, who held courts for the trial of causes; and the hundred is still liable for damages by unlawful acts.

Alfred also was said to be the contriver of trial by jury, but we have evidence of such trials long before his time. In a cause tried at Hawarden, in Flintshire, nearly a century before Alfred, we have a list of the twelve jurors, confirmed too by the fact that the descendants of one

of them, called Corbyn of the Gate, still preserve their name and residence at a spot in the parish, called the Gate.

It is more probable that Alfred better regulated all these legal provisions, and perhaps the divisions of parishes also, of which the earliest list is that of Pope Nicholas, who, in 1291, ordered an account of the value of all English benefices to be taken, and which is still preserved.

Doomsday-book, or Dom-boc, was an account of a survey of all the lands of the kingdom, taken by the survey of commissioners and the labour of six years. It was lately printed from the original, still preserved at Westminster. It divides the land into oxgangs or bovates of 12 or 15 acres; virgates of 40 acres; carucates of 8 oxgangs, or 100 acres; and hides of about 120 acres, or more.

Danegeld was a land-tax imposed by Ethelred, to enable him to expel the Danes, but retained after.

In Doomsday-book a carucate, or 100 acres, was valued at only 32*d.*, and 4 at 10*s.*; and sometimes at only 8*s.*

It appears that the annual revenue of the crown lands, between the Mersey and the Ribble, was, in the reign of Edward the Confessor, but 149*l.* 16*s.* 10*d.*; and, taken as crown-lands at 10 times too little, and money at 100 times greater worth, the whole was under 150,000*l.*; the same tract, as returned under the property-tax in 1814, was worth 2,569,761*l.*

The Conqueror gave 398 manors to Roger de Poitou, who built Lancaster and other castles; but rebelling against the tyrant, the whole were given to his son, William Rufus. They constitute the Duchy of Lancaster Estates, but are now much curtailed; hence arose the great power of the Dukes of Lancaster.

Edward III. made a levy of shipping to convey his army to France, in 1338; and assessed London, 25 ships and 662 men; Bristol 24 ships, and 600 men; Hull 16 ships and 466 men; Portsmouth 5 ships and 96 men; and Liverpool 1 bark and 6 men. For the kingdom, 700 ships and 14,141 men.

When Charles I. levied ship-money, in 1636, he assessed London 7 ships of 4000 tons, and 1560 men; Yorkshire, 2 ships of 600 tons, or 12,000*l.*; Bristol, 1 ship of 100 tons, or 1000*l.*; Lancashire, 1 ship of 400 tons, or 1000*l.*; Hull, 140*l.* towards Yorkshire; and Liverpool 25*l.* towards 1000*l.* for Lancashire.

At the Reformation, from 1538 to 1544, Henry the Eighth unmercifully dissolved and seized on the revenues of 645 monasteries, 375 convents, 96 colleges, 2374 chantries and free chapels, and 110 hospitals; giving the possessors a trifling annuity or simple donation. The proceeds were nearly 5 millions sterling, or 50 millions in our present money; and their estates he lavished among his favourites and courtiers, sending all opponents to the stake or the block.

The *Book of Innocent Sunday Sports*, liberally published by James I., on the principle that Sunday is a Christian festival, so offended the Puritans, that its sanction by Charles I. was a primary cause of the civil wars. The Puritans regarded Sunday as the Saturday of the Mosaick law, and adopting a Catholick festival as the real sabbath, insisted on keeping Sunday, the first day, just as the Jews keep Saturday, the *seventh* day, or the ordained sabbath of the fourth commandment. The liberal views of James and Charles did not however, suit the religious prejudices of that day.

The first clothing fabricks in England were made in the reign of Edward III., and called Kendal cloth and Halifax cloth.

In 1253, wheat sold at 2*s.* 6*d.* per quarter; in 1272, a labourer got 1½*d.* per day; and a harvest man 2*d.* In 1256, brewers sold 3 gallons of beer for 1*d.* In 1248, the king paid 18*s.* 4*d.* for 37 sheep, or 6*d.* each.

In 1300, wheat and barley fetched 3*s.* 4*d.*, and oats 1*s.* 8*d.* per quarter; a cow, 6*s.*; a fat sheep, 1*s.*; a hen, 1½*d.*; and a pair of shoes 4*d.* Labour from 1½*d.* to 2*d.* per day.

In 1314, parliament fixed the price of a fat ox at 16*s.*; a cow, 12*s.*; a fat hog, 3*s.* 4*d.*; a sheep, 1*s.* 2*d.*; a couple of chickens, 1*d.*; a goose, 2½*d.*; and eggs, ½*d.* per dozen. Arable land, in Kent, let from 3*d.* to 6*d* per acre;

pasture at 1*d.*; and meadow from 4*d.* to 10*d.*

In the middle of the 14th century, wine was 4*d.* per gallon; wool was 2*s.* per stone; Kendal cloth, from 3*s.* 4*d.* to 5*s.* per piece; wheat, from 4*s.* to 6*s.* per quarter. In 1500, oats were 2*s.* per quarter, and wheat 6*s.*; ale, 2*d.* per gallon. Labour, 2½*d.* to 3½*d.* per day.

In the 16th century, wheat averaged 21*s.*; and labour 8*d.* per day. During the civil wars, wheat averaged 3*l.* 12*s.* At the Revolution, it was 1*l.* 19*s.* At the Accession of George III., wheat was 33*s.*; barley, 20*s.*; and oats, 15*s.* Labour, 1*s.* to 1*s.* 6*d.* per day.

Before 1300, 11 oz. 2 dwts. of fine silver, and 18 dwts. of alloy, were equal to 20*s.* In 1412, the same was coined into 30*s.*; and, in 1527, into 45*s.* But, in 1545, 6 oz. of silver and 6 of alloy were coined into 48*s.*; in 1546, but 4 of silver and 8 of alloy into 48*s.*; and, in 1551, the 5th of Edward VI., but 3 of silver and 9 of alloy were coined into 72*s.* Elizabeth, in 1560, restored the old standard in 60*s.*; and, in 1601, in 62*s.* It is now 66*s.*, of the same standard.

In the reign of Elizabeth, a house, in a country town, let for 4*s.* or 6*s.* per annum; and the purchase was 5*l.* or 6*l.* Wheat was 1*s.* a bushel; malt and oats, 7*d.*; an ox, 26*s.*; and a fat sheep, 2*s.* 10*d.* Claret, 2½*d.*, and red port, 3*d.* a quart. Labour 4*d.* to 6*d.* a day.

The rental of Scotland, about the period of the Union, was but 317,018*l.*; but, in 1812, it was 6,108,050*l.*, money being five times less valuable, so that improvements had increased it four-fold. The population was under 1 million; but, in 1821, it was 2 millions. The ships had increased, too, from 215 to 3160; and the revenue was, in 1822, 40 times greater than in 1707; or 110,694*l.* and 4,292,567*l.*

The free parts of the English constitution, and the securities of civil liberty, were procured by Magna Charta, in 1216,—by Simon Montford, Earl of Leicester, who obtained the first parliament in 1256, by the concessions of Edward I., in return for subsidies to sustain his wars,—by the Trial by Jury,—by the Petition of Right, drawn by Lord Coke,—by the Habeas Corpus Act, drawn by Lord Shaftesbury,—by the Bill of Rights and Act of Settlement, by the Libel Bill of C. J. Fox,—by the Catholick Emancipation Bill,—and, finally, by the Reform Bill of 1831, planned by Lord Grey. The system would be perfect if sheriffs were obliged to summon juries in exact rotation from three districts; if elections were made by ballot, so as to render volition free and bribery useless; and if members of municipal corporations were chosen by the inhabitant house-holders.

The English champions of civil liberty, since its object has been understood, were—Hampden, Pym, Fairfax, Hollis, Coke, Vane, Ludlow, Lilburn, Milton, Sidney, Russell, Marvel, Fletcher, Locke, Burnet, Swift, Holt, Shippen, Glover, Chatham, Wilkes, Camden, Erskine, Cowper, Fox, Sheridan, Whitbread, Paine, Priestley, Price, Tooke, Stanhope, Perry, Belsham, Romilly, Wakefield, and Cartwright.

The best Reading Histories of England are those of Rapin, Hume, Smollet, Henry, Coote, and Lingard. Portions of Clarendon, Turner, Hallam, Belsham, Burnet, Ludlow, Lyttleton, and Spelman. The peculiar histories are Andrews, Enfield, Lloyd, Robertson, Milton, Anderson, Macauley, Plowden, Lawless, Walpole, Guthrie, and Whittaker. Then there are the Chronicles of Beda, Gildas, Geoffrey, Froissart, Baker, Stowe, &c.; besides county and local histories in immense variety.

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ANCIENT HISTORY.

History is a record of the external circumstances, or general results of a course of public events. Its records were vague, traditionary and erroneous before the invention of letters, about 1500 or 1800 B. C. The earliest records were the Egyptian hieroglyphicks, the first step towards letters, and some monuments, whose objects were described by exaggerated tradition, or, when forgotten, imagined. After the invention of writing, most people kept public scribes, or chronielers, but as these records like the London Gazette,

were subservient to the state, so the constant object of servile scribes was to gratify prevailing interests. But even of these, few have descended to our time in a perfect state, and we have, even in them, to depend on the translation of obscure and forgotten tongues, while the whole are mingled with the errours and superstitions of the age and people among whom they were written. Next to the Egyptian hieroglyphicks, the celestial globe, made about 1200, in depicting the heroes of incidents of the previous and passing age, is one of the least suspicious monuments; coins are others. The Chronicles of the Jews, beginning about 1200, the Parian Chronicle, the Histories of Herodotus and Ctesias, and the poems of Homer, are therefore the foundations of early ancient history.

That mankind had attained great perfection in other arts and sciences, before the art of writing or recording was invented, is evident from monuments, especially those in Egypt, and all those connected with astronomy, a science of long observation and profound research. The Zodiack of Tentyra, at Paris, is proved, by the precession of the Equinoxes, to be 5400 years old, and another, at Esnai, indicates much greater age—some French writers say 14,000 years.

Early ancient geography lay in a narrow compass; Greece and Italy were the extent north and west, and the Indies in the East. The Persian Gulf, the Caspian, the Euxine, and the Mediterranean, bounded the countries consecrated in Ancient History, and which extended over 20 degrees of longitude, or about 900 miles, by 12 degrees of latitude, or 1800 miles. Arabia and Egypt lay to the southwest, Chaldea bordered on Arabia, south of the Euphrates: Babylonia lay on that river; Mesopotamia lay between it, on the Tigris; Assyria was in both; Media to the west, and Parthia to the north; Syria lay to the west, and its extent was but 400 miles long, and about 100 wide. They were large only in the eyes of the Greeks, but Bengal, some of the American States, and even France to the Rhine are, either of them, equal to the ancient empires.

The ancients knew as little of the surface of the earth, as the moderns of the interiour; Homer called all barbarous, remote from Greece; and beyond Thrace was the hyperborean region of darkness; and beyond Ethiopia, the region of light inhabited by Pigmies. The whole was surrounded, at the distance of 500 miles, by the River Ocean, by which the Argonauts returned from Colchis in the Black Sea; Eratosthenes and Strabo extended the land farther, and gave limited form to the old continent, but omitted China, and made Lybia, Africa. Orpheus, Herodotus, Pliny, &c., were equally incongruous, and referred every thing to the Mediterranean, as a centre. The priests taught that the Temple of Apollo, at Delphos, was the centre of the world. Beyond the Archipelago and the Levant all was fable, and they believed that the whole plain of the earth might be viewed from any very high mountain. Some philosophers, as Thales, Aristotle, &c., taught that the earth was a sphere, but the vulgar believed the priesthood, who placed their hell under ground, or beyond the sea.

History necessarily begins with the art of recording, or writing, and this art appears to have been first exercised in Greece and the west, about 1500 or 1800 B. C. Like all arts, it doubtless was slow and progressive, and the first authors were, probably, not the inventors. Sensible hieroglyphicks would precede more refined ones; these would be long in taking the form of letters, and these long in being adopted and acquired. Till then, all previous history would be tradition, and the value of tradition, in 1500 or 1800 B. C. may be estimated by its value at this day among the negroes, the American Indians, or the New Hollanders. In England what is the value, even in this age, of any tradition, beyond two or three generations? and, when preserved, it always degenerates into miracle and absurdity.

All well-informed nations appear, after the invention of writing, to have kept chroniclers, who were the priests or astrologers; and these generally prefixed some cosmogony, mingled with claims of antiquity, with popular legends, &c

The Greeks refer the invention of letters to Cadmus, about 1500, merely

because he introduced them from Phœnicia; the Egyptians to Memnon, about 1800, who probably borrowed them from the Hindoos; and these again improved on those of the Chinese, whose 214 keys, sustained by inflexible customs, were apparently the first transition from hieroglyphicks to generick characters. Each key depends upon the number of strokes in it, and expresses a genus of ideas, while the hieroglyphick origin of the radix of most of them is palpable. It is a vulgar errour that they have 80,000 characters, and they might infer that we also have as many as words, our characters for each word being different, on the same principle as theirs.

Temporary notoriety is always in the inverse ratio of permanent celebrity. That which strikes the vulgar and ignorant, is not calculated to endure the cool examination of intelligence; and that which satisfies the intelligent few, is not understood by the vulgar multitude. Every seven or ten years has its vulgar prodigy, but the pantheon of Universal History rejects all these popular idols, and consecrates none but truly original minds, applied to subjects of substantial and universal interest.

The earliest known chronicles are those of the Chinese, Hindoos, Jews, and perhaps those of the Irish nation. Their imperfect knowledge of physicks, their general recognition of astrology, and their being in the hands of the priests, have filled them with fables. Some natural facts enable us, however, to infer that sciences, the fruit of leisure, wealth, and power, existed; and thus we find, that the Chinese record an eclipse in the year 2800 B. C., and a general conjunction of the planets in 900 B. C.; we find, also, that the Hindoos record eclipses 3180 years before the Christian era; also, that the Persians describe positions of stars in the equinoxes 3000 B. C.; that Alexander found at Babylon celestial observations for 1902 years, in 330 B. C.; and the Egyptians claimed observations for 480,000 years, which, taken as the astronomical period of days, would be 1500 years. These recorded observations have been examined by modern tables, corrected by refined theories and they exactly agree. There is, therefore, no doubt or question that these nations were astronomers 3000 B. C., of course, also, they *wrote* their observations; and hence the bases of Grecian history, founded on the story of Cadmus, &c. must be false.

Fohee formed the Chinese code between 2900 and 2500 B. C. Confucius, their moral teacher, flourished about 600 B. C.

The Hindoos begin the creation as a mere astronomical epoch, when all the planets were in Aries, or nearly 2000 million of years since; and then, taking in the motion of the nodes and apsides, they extend it to 4320 millions, which they call a *Calpa*, or day of Brahma. The *Yug* is a period which brings the sun and moon only into the same situation in the first of Aries, or in every 4,320,000 years, an entire Calpa being 1000 Yugs. Then 100 Calpas are considered by the priest as the life of Brahma, 50 of which have expired. A Manwantera, or 306,720,000 years, is 71 Yugs of 4,320,000 years each, and the world is now in the 28th of the Satya Yug, and 7th Manwantera of 14.

A vicala of time is 6 respirations, or 18 seconds, and 60 vicalas are a *danda*, or 18 minutes. A sidereal year is a day of the gods.

Moses, the inspired author of the Book of Genesis, fixes the date of the creation 4004 B. C.

The birth of Abraham was, by the Vulgate, about 1996 B. C.; but if 430, instead of 215, be taken for the sojourn in Egypt, then his birth was in 2211. The epoch of the Deluge depends on the time assigned to the tenth and eleventh chapters. The Septuagint gives about 1100 years, and Josephus 850. The former then would fix the deluge about 3300, or 1000 years before Jerome's Vulgate. An astronomical cause would carry it back another 600 or 700 years, or to 3900, or 4000 B. C. the period assigned by the Vulgate for the epoch of Adam. The Vulgate Chronology embarrasses every thing, but the Septuagint, Josephus, and the Samaritan version, accord far better with all other ancient history.

As the Jews were ignorant of

chronology, the guesses of commentators lead to many discrepancies. The Septuagint, no mean authority, supported in a great degree by Josephus and the Samaritan version, assigns to the period in the 10th and 11th of Genesis, from the Deluge

to Abraham .. .	*Years* 1257
from Abraham to Jacob ..	290
Sojourn in Egypt per Exodus	430
Departure to Solomon .	873
Solomon to Christ .	1156
	3906

instead of 2348, by the Vulgate. Taken thus, the Jewish history embraces all the demands of the astronomical records, and the combined pretensions of general ancient history, while 1831 added to 3906, gives 5737 years since the deluge. Then, if we look for the physical cause, it will be found that the Perihelion, now in 10 degrees of Capricorn, (having a period of 20,900 years,) crossed the Equator 5800 years ago, when the translation of the ocean from the northern to the southern hemisphere, would necessarily produce those wrecks of countries, and great changes which the record implies, for all history concurs in describing a deluge, and science demands its recurrence every 10,450 years.

Diodorus Siculus, Tacitus, Celsus, the Emperor Julian, &c., describe the Jews as Cretans, who settled in Idumea, so called from Mount Ida, in Crete, and hence the name of Judea. They also record, that a contagious leprosy breaking out in Egypt, Amenophis and Ramesis drove all the deceased into the deserts of Idumea, where their chief was Moies, a former priest of Osiris, and under his institutions they finally settled themselves in Judea. Their exclusive ordinations and tenacity in maintaining them, drew on them the special hatred of the various ambitious conquerors of the East; and the Romans, in particular, exterminated them with remorseless cruelty, till they expelled them from the district, and made them unintentionally, as itinerant traders, in general connexion, the merchants and money-dealers of the whole world. Their present numbers in all countries must be immense. They are estimated at 4 millions in Europe, 2 in America, 6 in Africa, and 12 in Asia.

The modern Jews profess to date from the creation, but this confounds all chronology and history. But if, which is far more probable, their epoch was the deluge, then, as the year 1831 is their year 5591, so the epoch of the deluge would be 3760 B. C., instead of 2348, as adopted by Usher, &c. This would expand the Jewish chronology, so as to embrace the pretensions of ancient history in general, and accord with ancient astronomical observations; while, as the Perihelion crossed the equator in 3970, we should have a physical cause for an event which all history confusedly records, and of which the earth's surface affords incontestible proofs. The variation of 210 years would arise partly from the waters, extending variously and retiring variously. The extension of 15 or 1600 years is justified by conferring a suitable period on the great events recorded in the 10th and 11th chapters of Genesis, to all of which, the received chronology assigns but 100 years.

The year of the world, by the Alexandrian and Abyssinian accounts in 1831, is 7323. But the Jewish reckoning is 5591, doubtless from the flood. It is also 4932 of the Hindoo Calilug.

The chronology of Newton is not insisted on. He fixes the foundations of Argos and Athens in 1080; but the received chronology assigns 1856 to the first, and 1556 to the second. Minos reigned, in Crete, in 1400; and Theseus, in Attica, in 1234. Orpheus flourished, about 1280; and the Trojan war lasted from 1193 to 1184. Homer and Hesiod lived about 900, and the Olympiads began in 776. The Romans destroyed the independence of Greece by the taking of Corinth in 147 B. C., and in the second year of the 158th Olympiad.

All systems of chronology agree that Cyrus took Babylon in 538 B. C.

The Jabal, Jubul, and Tubal-cain, of Genesis appear to be similar characters to the Pan, Apollo, and Vulcan, of the Greek Mythology. Lamech, their father, and the son of

Mathusael, or Methuselah, was descended from Cain, by chap. iv., and from Seth, by chap. v., which latter makes Lameeh the father of Noah, consequently the fathers of the arts, as Noah was their brother, were drowned in their brother's flood.

The Jews were of three parties, the Hierosolymites or people of Jerusalem, who claimed to have the only temple; the Samaritans, who occupied the district of the ten dispersed tribes, and had a temple of their own, and their own version of the scriptures; the Hellenist, or Greek and Egyptian Jews, who had a temple at Bubastis, called the Onion.

It happened that no Greek writer quoted the Jews or their histories; and Josephus assigns, as a reason, that Theopompus, a Greek historian, who proposed to notice them, went mad, and discovered his crime in a dream; and that Theodectus, a great dramatist, who noticed them, was struck blind, and recovered his sight only by penance. Other Greek writers therefore took warning!

Berosus, an ancient Chaldean, relates that Xixutor, *tenth* King of Chaldea, was warned by the god of the country to build himself an ark, to escape a deluge. Its length was 5 stadia, and width 2, *i. e.* 3000 feet and 1200 feet. He launched it on the Euxine, and took in his relations, and birds and beasts. The flood abated and his vessel settled on Ararat; before which, Berosus relates the particulars of his sending forth birds. This account was probably copied from the Jews. The Jewish ark was 300 cubits by 50, and, if great cubits of 11 feet, 3300 feet by 550, and 330 feet high.

Buffon thinks that the Grecian and Hebrew deluges were the same, and arose from the Atlantick and Bosphorus bursting into the valley of the Mediterranean. In truth, the Black Sea appears to have drained the channel, which anciently ran from the Caspian to the Baltiek; and Dr. Clarke insists, at length, on the certainty of this rupture between the Black Sea and the sea of Marmora.

Sir W. Jones believes Baechus to be the Rama of the Hindoos, a great conqueror, law-giver, and improver of navigation and commerce. The Greeks called him the god of Wine.

The Arabs record a flood which destroyed Saba, their capital, and other towns, in early ages. It was caused by the breaking of a vast reservoir, equal to a mountain, built by Saba, and is called the inundation of Al Arem.

The Chinese claim an extreme antiquity; but the reports of their literature coming to us through Popish missionaries and prejudiced travellers, who pervert or mistake, it is difficult to arrive at the truth. Their physiognomy indicates that they are of the Tartar origin, or variety. It seems agreed that Fo-hee, their first emperor, reigned about the year 2950; and, from that time, their histories give a regular succession of emperors and events. Yao, who flourished about the year 2357, is celebrated for his virtues and wisdom, and is said to be the author of his own history, as given in their chronicles, his reign having lasted 102 years.

From Fo-hee to Shun, was 500 years; from Yu to Kie, was 387 years; from Tching-tang to Shcoosin, was 612 years; from Voo-Vang to Nang-Vang, was 808 years; from Nang-Vang to Cong-tee. was 105 years.

The Phœnicians, or the Philistines of the Jewish chronicles, invented writing, arithmetick, weights and measures, navigation, glass-making, and many other important arts.

The Phœnicians extended their trade and language to all the coasts of the Mediterranean, and established colonies at Carthage, Gades, and the coasts of Spain.

Sanchoniathon, the Phœnician historian, who wrote about 1150, calls the first pair Protogenus and Æon, and traces them down to Thoth, the Egyptian Mercury, but does not notice any intervening flood. He relates that the seventh generation discovered the use of iron, which Moses ascribes to Tubal Cain, the son of Lameeh, the 7th or 9th generation, and brother of Noah; but Sanchoniathan does not speak of the flood in which, according to Moses, Tubal Cain and Noah's

other brothers, Jubal and Jabal, were drowned.

Sanchoniathon, the earliest profane writer, assigns ten generations like the Jews to the early ages. He calls them Æon, Genos, Phox, Liban, Usou, Halieus, Chrisor, Technites, Agrove, and Amine. As he wrote at Beritus, in Phœnicia, and does not refer to the Jews, he is supposed to have lived before Moses, but the received chronology makes him 200 years later. He quotes the Egyptian Thoth, who lived 800 years before him.

These earliest recorded Names are as under, and merit consideration :—

Sanchoniathon.	*Genesis, chap. v. Genesis, chap. iv. & Chronicles.*
Æon	Adam — Adam
Genos	Cain — Seth
Phox	Enoch — Enos
Liban	Irad — Cainan
Usou	Mehujael · Malialaleel
Halieus	Methusael Jared
Chrisor	Lamech · Enoch
Technites · Agrove	Jabal — Methusclah / Jubal — Lamech
Amine	Tubal Cain. Noah.

Ninus and Semiramis were warlike sovereigns of Assyria, who, by large standing armies of nearly two millions of fighting men, overran central Asia to the Indus. Ninus left his wife guardian of his son, and she extended her conquests into Egypt and Ethiopia; but, in an expedition against India, she was totally routed by Strabobates, the king; and, after a reign of 40 years, she resigned to her son. In their time Nineveh was built and adorned, as a rival to Babylon. They flourished about the year 2150. Besides their vast armies, they had 10,600 armed chariots, and fleets of fighting ships; while other kings brought nearly equal forces into the field, and terrible slaughters covered this garden of the world. The empire lasted 1400 years; but, in 771, was overthrown by a conspiracy of three viceroys, who divided it into the three kingdoms of Assyria, Babylon, and Media. Such are the accounts of the Greek and Roman historians. The Assyrian kingdom, 150 years after, was conquered by the others, and Nineveh destroyed.

The name Babel, or Babylon, meant the City of God. The Persians refer its foundation to Tamarath. Alexander found in it celestial observations for 1903 years. Herodotus makes no mention of the Nimrod of the Jews.

The Jews were in possession of Canaan from about 1100, the age of Samuel, and Saul, to 721, when 10 of their tribes were dispersed, and the other two tribes maintained themselves till 587, when the kingdom of Judah was overthrown by Nebuchadnezzar. Cyrus restored them in 536; but they were a province of the Persian empire till 332, and then a province of the kingdom of Syria, till that kingdom merged in the Roman empire, under which they were finally expelled the country in 70, A. C.

Moses, the Jewish legislator, headed them in their departure from Egypt about 1491; the epoch of the building of Thebes, and the introduction of letters by Cadmus.

The Samaritan Jews, or kingdom of Israel, recognised, as the basis of their religion, only the Pentateuch, and rejected the rest, reading the Book of Judges as Apocryphal. The Christians, from the time of the fathers of the Romish church, recognise the whole Jewish history as of divine inspiration.

The Canaan of the twelve tribes extended from lat. 31° 15′ to 33° 5′, or 130 miles long; and, from longitude, 35° to 36° east, or 45 miles wide. The two tribes of Judah and Benjamin were about 40 miles long and 30 wide. Samaria lay 40 miles north of Jerusalem.

The whole kingdom of the Jews lasted only 120 years; of Israel, separately, 246 years longer; and of Judah 370 years; and both were then merged in the Babylonian empire, then in the Persian, the Macedonian, Roman, Saracen, and Turkish empires. Egypt was independent till 569 B. C. from the earliest ages, and then was merged in the same empires.

The Island of Atalantis is described by Plato, in his Timæus, as of vast extent and population, having existed somewhere in the Atlantick, but was swallowed or absorbed by an earthquake. Many Hindoo legends

point to the circumstance; and Whitehurst quotes, in proof, the geology of the coasts of Ireland.

The Arundelian Marbles, or *Marmora Oxoniensis*, were, with other Grecian antiquities, collected by Dr. W. Petty, in the reign of James I., at the expense of the Earl of Arundel. The whole consisted of 37 statues, 128 busts, and 250 inscriptions, besides gems, altars, &c. The Earl's grandson presented the inscriptions to the University of Oxford. Dean Prideaux published them in a folio called *Marmora Oxoniensis;* and other accounts, by Mattaire and Chandler, have since appeared. The Parian Chronicle is in capitals, without spaces or stops. In one of them the parties swear to a treaty "by Earth, Sun, Mars, Martial Minerva, Diana, Hesther Sipylene, Apollo in Pandi, Venus Stralonieus, and all the other gods and goddesses." On the tomb of a Phœnician it is stated that "he and his wife are with the blessed in Elysium;" hence, the doctrine of a future state seems to have been familiar with the early Greeks. It seems to have been engraved about 170 years B. C. The second epoch states as follows:—"Since Deucalion reigned at Parnassus, in Lycorea, Cecrops reigning at Athens, 1310 years." Epoch 4 states, "Since a deluge happened in the days of Deucalion, and he fled from the rains out of Lycorea, taking refuge with Cranaus; and built the Temple of Phyxion and Olympian Jupiter, and offered sacrifices of preservation, 1265 years, Cranaus reigning at Athens." This flood in Thessaly, then, was in 1435 B. C., but the deluge of Moses was 2348; and, hence, there is no reason for confounding those events. Moses died 1452, 17 years before Deucalion's flood. The same inscription also tells us, that the first ship from Egypt arrived in Greece in 1512 B. C., i. e. about 14 years before the Israelites left Egypt.

The Greeks spread from Greece, through all the Islands, to the coasts of Asia Minor, to Sicily, Lower Italy, and on the coasts of the Euxine. In Africa, they founded Cyrene; in Gaul, Marseilles; and to the west, Rhoda and Emporia. The Macedonian conquests extended their language into the interiour of Asia.

Iron was said to have been discovered owing to the forests on Mount Ida being burnt by lightning, about 1500 years B. C. But Moses refers it to Tubal Cain, the son of Lamech, and one of the brothers of Noah, who, with Jubal and Jabal, the other sons of Lamech, must have been drowned in the flood 800 years previously; though Moses speaks of their arts as continuous, and describes them as the fathers of all who practised their arts. The discovery of iron would effect a social revolution, equal to that of gunpowder.

Some suppose that the Canaries are fragments of that extensive island of Atalantis, which Plato, in his Timæus, says was absorbed by the sea, 9000 years before his time. The sea is said to be shallow in that vicinity. Pliny mentions traditions of the irruption of the Atlantick into the basin of the Mediterranean.

The Bacchus of the Greeks had some resemblance to Moses, if they were not the same. Orpheus, about 1200, calls him *Mises*, (saved from the Nile), educates him in Arabia, makes him pass dry through the Red Sea and two rivers in India, command the Sun to stand still, cause wine to spring by striking the ground, and engrave his laws on two tables of marble. The Egyptian histories, cited by Josephus, Clement, Origen, &c., are silent on the subject.

The Assyrian is the earliest recorded empire, that of Bacchus wants records. It began with Ninus, and ended with Sardanapalus. It was united to the Medes, from Arbaces to Astyages, and then to the Persians, from Cyrus to Darius.

The Argonautick expedition to Colchis, in search of the Golden Fleece, under Jason, begins now to be regarded as a fable; and many learned writers doubt whether the Siege of Troy was other than a poetical fiction of Homer. The only circumstance that gives it credence, is Alexander's recognition of it, by his visit to the tomb of Achilles. Others think there was no such poet as Homer, and that his poems were the work of Thales, who first promulgated them in writing.

The Zodiack of Tentyra, now at Paris, is a spiral, beginning with Leo,

and ending with Cancer, in a square of 7 feet 9 inches. It is crossed at right angles by lines, which pass through Taurus and Scorpio, and through Leo and Aquarius; then the Equinoctial and Solstitial points. Hence, a sign and a half gives about 3240 years. But Pisces has since advanced through Aries, so the precession is full $2\frac{1}{2}$ signs, or $2160 \times 2\frac{1}{2} = 5400$ years for the age of this Zodiack, or 3130 B. C., which corresponds exactly with age of the Indian Observatory.

It hence appears that the Zodiacal signs are of extreme antiquity, and that the first in order was Leo. The sphere, and its constellations, with the names of the planets, appear nevertheless to be of Cretan origin, and the author of the nomenclature, palpably, had Cretan and Grecian personages in his mind. All history fixes these personages as living in the ages just preceding the Trojan war, for the constellations do not record that war, or its heroes, but they include Persius, Hercules, the Argonauts, &c. &c. of the immediately preceding age.

The celestial globe was divided into constellations after the age of Persius, and also after the Argonauts, who built Mycenæ, perhaps, about 1200 B. C.

The Ancients assigned the 12 *major Gods and Goddesses to the* 12 *signs of the Zodiack.*

Aries	Minerva
Taurus	Venus
Gemini	Apollo
Cancer	Mercury
Leo	Jupiter
Virgo	Ceres
Libra	Vulcan
Scorpio	Mars
Sagittarius	Diana
Capricorn	Vesta
Aquarius	Juno
Pisces	Neptune

Saturn governed ♒ and ♑
Jupiter ♓ ♐
Mars ♈ ♏
Venus ♉ ♎
Mercury ♊ ♍
The Moon ☋
The Sun ☌

The Egyptian Zodiac commenced with ☌, the sign of the Sun. The Moon, or ☋, precedes it. Mercury, *i. e.* ♊ and ♍, is next to these, corresponding with his elongation. Venus next, *i. e.* ♉ and ♎, each way; then Mars, ♈ and ♏, then Jupiter, ♓ and ♐, and, lastly, Saturn ♒ and ♑.

Crete, or Candia, always deserves to be mentioned with respect, as the nursery of civilization, a circumstance favoured by its insular position, the fineness of its climate, and the fertility of the soil. Among the earliest monarchs were Rhadamanthus and Minos, whose laws and policy were so much praised. The Cretans lost their independence when the lust of conquest was indulged by the Romans, about 50 B. C. In the age of the Trojan war, Crete was said to contain 100 cities, which, a modern traveller says, may all be still traced.

The stars were classed into constellations about the year 1200, for the figures include all the heroes of the previous age, some of the Argonauts, but none of the Trojan heroes. The same systematizer also gave names to the planets, and adopted those of recent celebrity in the Cretan court as Kings; Saturn, Jupiter, Vulcan, &c. Astrology sanctified these names, and poetry soon deified them. Their numerous progeny arose from the ascendancy of these planets at births, and a man born when Jupiter was strongest, and Cancer ascending would be called a son of Jupiter and Latona, or of Jupiter and Diana. The Astrologers were at once the priests, poets, and statesmen; and, hence all the fables and superstitions about these names given to the planets and stars. They afterwards travelled among eastern astronomers and astrologers.

The Greeks had a story that Orion was the son of Hyreus, and formed at his request by Jupiter, Neptune, and Mercury, after he had entertained them, he being old and childless. Orion is named in the Book of Job, which is believed to be of Chaldean origin, and as old as Genesis.

The ancient mythology made Apollo, the Sun, brother of Diana, the Moon, merely because ☌ and ☋ adjoined each other.

The Argonautic expedition, under Jason, to Colchis, took place, if not

a fable, about 1250 B. C. It affords names for constellations.

Saturn appears to have been King of Crete, in whose time *Iron* was discovered on Ida, by the conflagration of its woods. Jupiter was his son, and successor. Mars was a Cretan hero of the same age. Venus was a beautiful Cyprian, who married Vulcan, who wrought the new iron mines, and made iron implements. Mercury was Hermes Trismegistus, to whom the age was indebted for the recent discovery of letters. The Sun, or Baal, had many names, but at this time the name of an accomplished native of Delos, Apollo, was assigned. The Moon, also, had many names, but, in the Cretan Vocabulary, she was called Diana. The virtues and powers ascribed to the planets by astrology were soon, by association, referred to the name and the persons; while superstition, obscure history, priestcraft, and poetry, in 2 or 300 years, raised on this simple basis, the amusing fabrick of the Heathen Mythology. In these ages, even as at this day, in eastern courts, the astrologer was also priest and statesman, and the reigning planet, at the birth of a man, or at the founding of a City or Temple, was the father or genius; hence, the apparent numerous progeny of these gods, and their multiplication in different persons and places.

Many confusions in ancient history were thus created by astrology. Lucian says, that Æsculapius was called the son of Mars, merely because Mars was lord of his ascendant; and so another was the son of Jupiter, because Sagittarius was ascending at his nativity. Cities too had their nativities, and hence the lord of the ascendant was their tutelar deity, and his or her worship adopted in a tangible form. The first stone of a city, or great structure, laid when Cancer was ascending, would render the Moon, as Diana, Cybele, Isis, &c. their future goddess. The hour in which a victory was gained, which founded a nation, was also, to an astrologer, a means of setting a figure, and fixing the lord of the ascendant; and thence the tutelar deity of that nation! and, on this, an astrologer and poet, aided by the celestial globe, and the approaches, and recessions, and aspects of the planets, would raise a story to astonish the vulgar, and all men unacquainted with the art. At this day adepts in astrology set figures, even at the launching of a ship, and pretend to tell its fortune; and, when astrologers were statesmen, and the people reverenced the art, no doubt the astrologers fixed the ruling planet, and the deity of the place, whose name was varied according to the language of the people. Half the mysteries of ancient history, and all those of mythology, may thus be explained. The fables about the heathen gods are such, therefore, only from ignorance of this key, and astrology; and the celestial globe would tell, in a moment, how the gods (*i. e.* the planets,) and the female constellations, and the goddesses, (that is, Venus and the Moon,) and the male constellations, were guilty of so many intrigues, and parents of so many heroes, at a time when astrologers were statesmen, chief-priests, &c.

Astrology perverts and misapplies a plain principle. There is a certain chance that any event may happen. Random guesses would not satisfy, but the stars afforded rules for guessing, and then, by following the rules, the astrologer ceased to guess. But, as a certain number of probable events must happen, so, as the prognosticks were founded on the stars, these were then said to rule the events. What follies and odd things have this mistake created!

Ogyges, about 1856, was the first king of Athens. Cecrops, the next noted king, was an Egyptian, and reigned about 1556. Theseus reigned in 1300.

Cyrus, the founder of the Persian empire, lost his life in a battle with a Scythian tribe, in 529 B. C. But Xenophon says he died in peace.

The chief magistrate of the Athenian republick was called the archon; and, latterly, they were nine in number, chosen annually, and serving as an executive government.

There were nine archons at Athens, and the first was called King; the second Archonte, or Judge; the third Polemarque, or Generalissimo; and

the others, Thesmothetes, or Lawmakers, chosen by ballot.

The Areopagus, or Senate-house, was built on a hill, in 1490 B. C.

The Turks call Athens, Setines. It acquired note about 1508 B. C. and was, for 487 years, under 17 kings. In 594, it became a republick. In 403, it was taken by Lysander, for the Lacedæmonians. In 87, it was taken by Sylla, for the Romans; and, in 1455, by Mahomet II. Its famous buildings were the Areopagus, the Lyceum, the Academy, the Portico, and the Temples. The assured independence of Greece promises its revival in 1830.

Athens was founded by Cecrops, 1556 B. C. Ægeus governed 1283. Theseus, 1235. Codrus, 1091. Medon, 1070. Draco, 623. Solon, 594. Pisistratus, 560. Pericles, 441. Demetrius, 317. Poliorcetes, 300. Taken by Sylla, 86.

Sparta founded by Lelex, 1302 B. C. Lycurgus governed 884. Theopompus, 770. Leonidas, 491.

Corinth built, 1520. Danaus reigned, 1485. Periander, 630.

Argos founded by Inachus in 1856.

Thebes founded by Cadmus, 1493. Œdipus reigned, 1266. Taken by Alexander, 336.

Lacedæmonia and Attica were the most renowned of the Grecian states; the first for military prowess, and the other for naval power, arts, and literature. Lycurgus arranged the severe institutions which gave character to one; and Solon, in 594, established those democratick institutions which drew forth all the genius of the people of the other; but they were too popular to last.

In 431, a dispute between Corinth and Corcyra, or Corfu, led to the interference of Athens and Lacedæmon, and brought on the first Peloponnesian war, in which all the Grecian states were mingled; but, in eight years, it ended in the triumph of Athens. A second struggle ensued; and, in 404, Athens was taken and dismantled.

The retreat of the 10,000 Greeks, under Xenophon, arose thus,—they were mercenaries of Cyrus the younger, and, in marching on Babylon, in 401, his army was defeated; but the Greeks kept in a body, and retreated through Asia to Thrace.

Sparta, so celebrated in Grecian history, was near the modern town of Misitra, in the Morea, but no vestige of it above ground has been visible for some hundred years.

Corinth, one of the most splendid cities in Greece, owed its advantages to commerce; and, to its luxury, we are indebted for the Corinthian order, in which were constructed the Grottos of the Muses, a Theatre and Stadium, a superb Temple to Neptune, and another to Venus.

Thebes, once the celebrated capital of Bœotia, has, by the Turks, been called Stives, and the country is called Stramulippa. Thebes was said to be built by Cadmus, an Egyptian emigrant, who called it after the Egyptian Thebes, and he introduced among the Greeks his alphabet of 16 characters. The fables connected with his history are all derived from a mixture of the superstition of priestcraft, with ignorant mistakes about astrological associations of men with the ruling planets, and aspects of planets in their nativities. The story of Jupiter and the Bull, connected with the early history of this district, means nothing more than Jupiter being in the sign Taurus, probably when Cadmus was born, when he landed, or when he laid the foundation-stone of Thebes, was in some aspect with the planet Venus.

The Amphictyonick Council was a congress of representatives from 13 cities in Greece.

The Greeks adopted their Olympiads in 776 B. C.; and previously their histories are jumbled in confusion.

The Romans had no chronology till a late period; and, hence, no certainty attaches to their history for 3 or 400 years.

The battle of Arbela, which ruined Darius, was fought Oct. 1, 331 B. C.

At the death of Alexander his generals were thus situated:—Perdicas and Leonatus were regents; Antipator and Crateras governed in Greece; Ptolemy held Egypt; Lysymachus had Thrace; Eumenes, Cappadocia, &c. Antigonus, Lycia, and Pen

cestes governed Persia; Python, Media; and Seleucus, Syria and Babylon. They established kingdoms, and some of them founded dynasties; but for the most part were military tyrants, and died violent deaths. The mother, wives, brother, and children of Alexander, were all murdered by them.

The Hindoos recognise the invasion of Alexander under the name of Mahadukoit Kounha, and call him the great robber and murderer.

The brilliant epoch of Grecian history was from about 600 to 300, or the period of Jewish history described by Nehemiah and the Apocrypha. But the history of neither corroborates the other, though so near; and no Greek writer of the classical ages speaks of the achievements of the Jews, though Homer was contemporary with David and Solomon. The art of printing has made nations acquainted with each other, yet the Greeks were travellers.

Rome was founded 753 B. C. by Romulus. Numa Pompilius began to reign 715. Tullus Hostilius, 672. Ancus Martius, 640. Tarquinius Priscus, 616. Servius Tullius, 578. Tarquinius Superbus, 534. First Consuls, 509. Lartius, Dictator, 498. Cincinnatus, Dictator, 456. Sylla, Dictator, 82. Julius Cæsar, Dictator, 48. Octavius, Emperor, 31 B. C. Tiberius, 14 A. C. Caligula, 37. Claudius, 51. Nero, 54. Galba, 68. Otho and Vitellius, 69. Vespasian, 69. Titus, 79. Domitian, 81. Nerva, 96. Trajan, 98. Adrian, 117. Antonius, 138. Commodus, 180. Severus, 193. Caracalla, 211. Alexander, 222. Gordian, 238. Philip, 244. Decius, 249. Gallus, 251. Valerian, 254. Gallienus, 260. Aurelian, 270. Probus, 276. Diocletian, 284. Constantine, 306. Constantius, 337. Julian, 361. Jovian, 363. Division of the Empire, 364, between Valentinian and Valens. Rome and West, under Gratian and Valentinian II., 375. Honorius, 395. Valentinian III., 424. Majorian, 457. Severus, 461. Anathemius, 467. Augustulus, 474. The Western Empire Dissolved, in 476, by Odoacer, King of the Heruli.

Though the Greeks and Romans stigmatized other nations as barbarians, and their misrepresentations are too generally received, yet the aggressions, ambition, and policy of the Romans in playing off nation against nation, and employing one to conquer another, cannot be sufficiently condemned. The union of nations to assert their own independence was just, and a philosopher will not condemn those associations of the northern tribes, which drove their oppressors into Italy, and even followed them there, though it might suit the Romans to call such patriots barbarians. The Romans provoked those attacks, and for all the consequences they alone are to blame.

The fortune of Rome was singular. It was founded by banditti 753 B. C.; from the year 100 B. C. to 300 A. C., the persevering policy of these insatiable bandits ruled the world by the sword; and from 300 to 1500, Rome governed all Europe by spiritual power, which is still acknowledged by half its states, and its language still reigns over all learning even after 2583 years.

The battle of Cannæ, so bloody and so fatal to the Romans, and so useless to the Carthaginians, was fought 216 B. C. Hannibal commanded, on one side, 50,000 Africans, Gauls, and Spaniards; and Paulus Æmilius 88,000 Romans, and not more than 4000 of the Romans escaped. Hannibal sent three bushels of rings of the Roman knights, to Carthage.

Agrarian laws, for the equal division of publick lands among the citizens of Rome, were first passed 486 B. C., and renewed 20 times, but in vain.

40,000 Romans were slain on the Allia, 390 B. C., by the Gauls, under Brennus, a British prince.

There were 7 kings of Rome, from Romulus, 753 B. C., to Tarquin Superbus, 509, when Brutus and Collatinus became consuls.

Carthage, the commercial rival of Tyre, and which, unlike Tyre, foolishly aimed at dominion as well as commerce, was built in the 9th century, B. C. They ravished the dominion of the sea from the Phœnicians, and maintained it for 5 or 600 years. Dido, a Tyrian princess, set-

tled herself at Carthage, owing to differences with her brother Pygmalion, and, upon an isthmus of a Peninsula, which formed a bay, she laid the foundations of Carthage. It was divided into three parts, Byrsa, or the city; Megara, or the suburbs; and Cothon, the port, the entrance to which was but 70 feet broad. The outer harbour was for merchants' shipping, and the inner for ships of war. In 2 or 300 years it was 23 miles round, and contained 700,000 inhabitants; a passage in Plautus proves that their language was identical with the ancient Irish, as it can be read at once by any lettered Irishman. Wealth and property were the only foundations of rank and power, and from this class two chief magistrates and legislators were annually elected. They worshipped Saturn, perhaps, because that planet ruled either at the birth of Dido, or at her landing on the coast; they also worshipped Baal, or the Sun, and Urania, the genius of Astrology. They traded through Africa, round the Mediterranean, and into the Atlantick, for they were masters of the Spanish peninsula. Rome and Carthage quarrelled about their respective ascendency in the Mediterranean, and the first punick war, of 24 years, began in 264 B. C., and the second punick war, of 17 years, began in 218, the third began in 149; and, in 146, Carthage was totally destroyed by Scipio, to his eternal disgrace. Gracchus began to restore it in 122, and in another 200 years it again became a considerable city, but, A. D. 431, it was utterly destroyed by Genescrick, the leader of the Vandals. Besides Spain, and probably Ireland and the Canaries, the Carthaginians held in the Mediterranean, Sardinia, Corsica, Malta, and the Balearick Islands. Their attempt to conquer Sicily diminished their power, and drew on them the fears and jealousy of the Romans. All commercial people have, in like manner, been ruined by a passion for territorial aggrandizement, partly with a view to the corrupting patronage of foreign governments, and partly for the purpose of forcing the sale of their commodities. Of the discoveries and science of the Carthaginians we have no knowledge, because we receive our accounts of them through their inveterate foes, the Roman authors.

Two of the most atrocious acts in the history of human crimes were the siege and destruction of Tyre by Alexander, and of Jerusalem by Titus. Histories which laud such monsters, ought to be consigned to the flames.

Cæsar's Commentaries were written by Hirtius, according to some; and by Oppius, according to others.

Voltaire, in his Philosophihal Dictionary, says that the word *Gauls* was a Roman corruption of the *Welches*.

Nero set fire to Rome on the 19th of July, 64. The fire continued 6 days, and consumed three quarters of that fine city.

Julius Cæsar usurped the supreme power, in 705, of Rome, or 48 B. C.; and, from that time till 475, there were 64 Roman emperors, the last being Augustulus. Their reigns averaged 8 years; and out of the 64, 45 were monsters of crime and vice.

The following was the Fate of the Cæsars, in 300 *years.*

44 B. C. Julius, assassinated.
14 A. C. Augustus.
37 Tiberius poisoned.
41 Caligula, assassinated.
54 Claudius.
68 Nero, killed himself.
— Galba, murdered.
69 Otho, ditto.
— Vitellius, ditto.
— Vespasian.
81 Titus.
96 Domitian, killed.
98 Nerva.
Trajan.
138 Adrian.
161 Antonius Pius.
180 Marcus Aurelius.
193 Commodus.
— Pertinax, murdered.
— Dedius Julianus, ditto.
210 Severus.
212 Geta, murdered.
217 Caracalla, ditto.
218 Macrenus, ditto.
222 Heliogabulus, ditto.
235 Alexander, ditto.
237 Maximinus, ditto.
238 Balbinus, ditto.
— Pupianus, ditto.

244 Gordians, murdered.
249 Philip, ditto.
251 Decius, ditto.
253 Gallus, ditto.
— Emilanus, ditto.
260 Valerian, ditto.
Gallienus, ditto.
270 Claudius II., died of the plague.
275 Aurelian, murdered.
276 Tacitus, ditto.
— Florianus, ditto.
282 Probus, ditto.
283 Marcus Aurelius, killed by lightning.
284 Numerianus, murdered.
285 Carenus, assassinated.
293 Caurasius, ditto.

What a consequence of undue power! what a picture of depravity in subjects! what a lesson to ambition!

In 305, Diocletian and Maximinus resigned, and thereby escaped the fate of 24 of their immediate predecessors;—but in

310 Maximinus was put to death.
311 Maximinus Galerius died shamefully.
312 Maxentius, drowned.
337 Constantine, died
340 Constantine II. killed.
350 Constans, murdered.
353 Magnentius, killed himself.
354 Gallus, murdered.
355 Julian, poisoned.
364 Jovian, died.
375 Valentinian, burst an artery.
376 Theodosius, murdered.
378 Valens, burnt.
388 Maximus, killed.
392 Valentinian II. strangled.
394 Eugenius, murdered.
395 Theodosius, died.
The empire was then divided.

Ancient History is considered as ending with the breaking up of the Roman empire in Italy, by the invasions of the northern nations, and the general conspiracy of the various conquered nations. These severally set up for themselves in various governments, which remained unsettled till the age of Charlemagne, from which period authors in general date the commencement of Modern History. Ancient History commenced, therefore, in the obscurity of tradition, between 1800 and 1500 B. C. and ended about the year 400 A. C., about 2000 years; and Modern began with Mahomet, or Charlemange, and has lasted about 1200 or 1000 years, beginning almost in as great obscurity as ancient history, owing to general ignorance.

MODERN HISTORY.

Modern History is marked chiefly by the extensive conquests of the Mahomedans, or Saracens and Turks, by the resistance of the Christians, and by the wars between the Roman Catholick and the Protestant powers. For one or two centuries, wars always were carried on to preserve a balance of power between the states, and prevent a general and oppressive monarchy. Latterly there have been bloody conflicts about civil liberty, between states free and states under arbitrary government; more recently Russia has appeared at the head of that northern hive, which, 1500 years ago, overran Europe. In Asia, the Mogul empire was founded by Genghis-Khan and Tamerlane, who overran Asia like Sesostris; but China has maintained its integrity for above 4000 years.

The Chinese empire was divided, between 420 A. D. and 581, by an eruption of the Tartars, into the north and southern empires. It was re-united in 581, and so continued till 905, when the Tartars again obtained part of the empire till 1249, and the Moguls governed the whole till 1368. The Tartars were then driven out, and a Chinese dynasty continued till 1644, when the Mantchoo Tartars overran the empire, and, after, five reigns, continue, under Kia-King, to govern. The last emperor but one, Kien-long, reigned 60 years, in great estimation, at home and abroad, and abdicated in 1796, in favour of his son Kia-King.

The Greeks knew nothing of the Chinese, and the Romans little, till Marcus Aurelius sent an embassy A. D. 166. In 530, the first silkworms were brought from China to Italy. The Saracens penetrated into China, and actually took possession of Canton in 758; in 1211, Gengiskhan conquered, and added part of China to his vast empire. About

1510, European traders began to visit Canton. At least 30 different embassies have proceeded from Europe to Pekin, many of them splendid and expensive, but the Chinese government received them as representatives of kings, sent to do homage!

Arabia never was conquered by any foreign nation. Its sands have been its security, and the poverty of the people has offered no temptation. Job was an Arab. Their power of story-telling is almost universal.

Mahomet was born at Mecca in 569, the year after the Abyssinian invasion, called the War of the Elephant; in which the Arabs say the invaders were destroyed by stones from heaven, and a flood of the Red Sea. His father was Abdallah, and his mother Amina, both of good family, and great beauty. His grandfather, Motalleb, took charge of him, and died at the age of 110. His uncle, Abu Taleb, brought him up as his own son, and took him, with a caravan, to Egypt and Syria; and he afterwards served in a campaign under his uncle, who was commander, and also guardian of the Caaba. At 25, he married Cadiga, a rich and noble widow, and lived in opulence. The religions of the Arabs were the ancient Sabeanism, Jewish, and Christian. At 40, he announced himself a prophet, and taught the Unity of God in opposition to the Trinity, and disclaimed the reverence which the Jews bestowed on Ezra. His first converts were his wife, his cousin Ali, his servant Zeid, and Abu Bekr, a man of distinction, who made five proselytes. He now preached in publick, in the courts of the Caaba, the belief and worship of one God, and began to produce the Koran. He was joined by Hamza and Omar, but opposed by the Koresh or Pagan priesthood. A deputation of 75 came from Medina, and acknowledged him. The Koresh now sought his life; and he fled, with Abu Bekr, to Medina, where 500 disciples met him. Here he adopted the kingly and sacerdotal office, established a mosque, and preached in it. He banished 700 of his opponents, and buried 700 alive, chiefly Jews, seizing their wealth. He soon after had an engagement with 1000 of the Koreish forces, and defeated them in the battle of Beber, in 623; after which he had 1000 warriors, and fought the battle of Ohud, but was defeated; and Medina was besieged by 12,000, and defended by 3000. The besiegers being baffled, a 10 years' peace was concluded.

Two years after, he gained a victory at Muta, over a large army of the eastern empire; and, in 629, he marched with 10,000 men, took Mecca, and destroying the 360 idols in the Caaba, consecrated it to his religion called Islamism. In another year, all Arabia yielded to his pretensions. He now marched, with 30,000 men, against the eastern empire; and, securing peace by his approach, he returned to Medina, and performed the Pilgrimage of the Valediction, with a train of 114,000 believers. He was supposed to be poisoned by a Jewess, and died aged 63, in 632, at Medina. The Mahomedans regard him as a man adorned with every virtue, and as the greatest legislator the world has produced. He was succeeded by Abu Bekr, the father of his second wife, in whose arms he died; and the Caliph advanced into Syria, while Caled pursued victory to the Euphrates. In 634, Damascus was taken; and, on the same day, died Abu Bekr, who bequeathed the Caliphat to Omar. Soon after was fought the battle of Yermouth, in which 150,000 Christians were slain, and all Syria became Mahomedan. They now invaded Egypt; and, in 641, the standard of Moslemism was established throughout that country. In the north and east they overran Persia, Armenia, and Mesopotamia. In 643, Omar was assassinated in the mosque, at Medina. Othman succeeded in 644; and his general, Abdallah, subdued the north of Africa; but, in 655, he was killed in a rebellion in his palace, and succeeded by Ali, the second disciple, and vizier of Mahomet. The widow of the prophet headed a rebellion against Ali, and though she was defeated and taken prisoner, his reign was turbulent, and he was assassinated by a fanatick at Cufa. In spite of their broils this Mahomedan, or Saracen empire, was, in 70 years, extended from India to Sibe-

ria, and from Samarcand to the Atlantick; while, in 704, they became masters of Spain and Portugal, and the empire exceeded in extent any recorded in history. In 760, Al Mansor removed the seat of empire to Bagdat; and, for 500 years, the caliphs made amends to science and literature, for the ravages of the fanaticks who succeeded Mahomet.

In 637, the Mahomedans first entered Africa, under Omar. In 650, they invaded Barbary. In 710, they overran Numidia and Lybia. In 973, Nigritia; and, in 1067, Lower Ethiopia; extending their faith to the Equator.

Bagdat, the famous capital of the caliphs, was founded in 762, by Al Mansor, near the site of Selcucia, or New Babylon, on the Tigris, and about 50 miles from Babylon the Great, on the Euphrates. The despots of these countries built capitals, and peopled them at their pleasure. Old Babylon yielded to New. New to Ctesephon. This to Almadayen, and this to Bassora and Bagdat, which were successively built by Omar and Al Mansor. Bagdat was the capital of the sovereign Caliphat, and the seat of science and the arts.

In 1258, Bagdat, which, for 500 years, had been the seat of luxury and civilization under the Abbasinian caliphs, was taken, plundered, and burnt, by Hulacu, at the head of an army of Tartars and Muscovites, and its men of science scattered over the world. It is still a fine city, and Bassora is its port, from which merchandise is brought in boats up the Tigris, and sent thence into the provinces.

In the 9th century there were six or seven caliphs, or Mahomedan sovereigns of Bagdat, Syria, Cairo, Fez, Spain, &c; but, about 1180 Saladin sunk the title in that of *Soudan* or *Sultan*.

The crusades are a memorable instance of the ascendency of priestcraft over the passions of mankind. About the middle of the eleventh century, Christian pilgrims found access to the holy land so difficult, that all christendom was aroused by Pope Urban II., to march under the banners of the cross towards Jerusalem. In the autumn of 1096, 200,000 of these fanaticks advanced from all parts of Europe to Constantinople, under the command of a priest of Amiens, called Peter the Hermit. On their route they killed all Jews; and the remnant which passed into Asia, were exterminated by Solyman the Great; but, in the following year, no less than 100,000 horse and 600,000 foot passed the Bosphorus, led by Godfrey, Hugh, Raymond, Bohemond, and Tancred, who defeated Solyman, and an army of 600,000 Asiaticks. In two years, they lost half a million; but, taking Jerusalem by storm, they put all (except the Christians) to the sword, animated to this deed by Peter. Godfrey was now made king of Jerusalem; and another army of 200,000 soon followed, but were cut off by the inhabitants of the countries through which they passed, as marauders, or destroyed in detail by Solyman. About 40 years after the King of France and Emperour of Germany, accompanied by St. Bernard, passed into Asia with 300,000 frantick followers, but were overthrown by Saladin, who, having retaken Jerusalem, staid the flow of blood, proclaimed free toleration to the Christians in 1187; but, in 1190, the kings of France and England, and the Emperour of Germany, proceeded with nearly half a million of men upon a new crusade. The emperour was drowned; and though King Richard gained a victory over Saladin, he returned alone; and in Austria, suffered a long imprisonment. In 1202, Baldwin set forth with another expedition; but quarrelling with the Greek empire, he overthrew the goverment, and was made emperour. Afterwards John of Brienne set forth, in 1219, and landing with 100,000 men in Egypt, took Damietta, but lost his army by an inundation of the Nile.

The last of these mad enterprizes was undertaken by St. Louis, King of France, who embarked with 200,000 men, conveyed in 1800 transports, under the banners of the cross, and landing in Egypt, was defeated by the Saracens, and taken prisoner in 1250, and, though well treated, and liberated in 1270, he embarked again, and landing at Tunis, he and most of his army perished by disease. It has been

estimated that these religious wars cost Christian Europe forty millions of lives, while they deferred the progress of civilization, and conferred a ferocious military character on the people.

In the religious battle, in Spain, with the Moors, Alphonsus II., about 800, slew 70,000 Moors in one battle. No quarter was given by opposite religions!

At the battle of Tholosa, in Spain, in 1220, Mahommed Al Nahur, the Moorish Emperour, was defeated, with the loss of 150,000 foot, and 30,000 horse slain, and 50,000 prisoners, by Alphonsus IX.; in 1340, Alphonsus XI. defeated them, with the slaughter of 200,000. Modern battles, even the crowning victories of Napoleon, were mere skirmishes to these almost forgotten slaughters, recorded by Mariana.

Constantinople was taken by Mahommed II. on May 29, 1453, and the Emperour Constantine Palcologus killed in the breach. There have since, or, in 377 years, been 24 Turkish emperours, reigning, on the average, 16 years.

Athens, with 200 other christian cities, was, in 1455, united to the Ottoman Empire by Mahomet II.

The kingdom of Poland rose to distinction under the Jagellan Dynasty, between 1320 and 1580. Muscovy was a distinct Selavonick race, and a province of Tartary till 1500. Prussia was a province of Poland till 1600. In 1773, 1793, 1795, and 1815, Russia, Austria, and Prussia confederated to seize on parts of Poland.

The siege of Belgrade, so often quoted, was undertaken in May, 1717, under Prince Eugene. In August, the Turkish army, of 200,000, approached to relieve it, and a battle was fought, in which the Turks lost 20,000 men, after which Belgrade surrendered.

The Mogul empire was divided into districts, governed by *Soubahs*, and these into local jurisdictions, governed by *Nabobs*. When the empire fell, these aimed at independence, and of their conflicts the East India Company took advantage, and made nearly the whole dependant or tributary.

The Buccaniers were European pirates, who, in the American seas, sought to divide with the Spaniards the wealth which they had plundered from the native inhabitants of Mexico and Peru. The vast extent of unoccupied coast afforded secure places of rendezvous, and their desperate courage made them masters of those seas. The first of them, whose exploits are recorded, was Pierre Frank, a Dunkirk man, whose success was of short duration. The second was Bartholomew, a Portuguese; he was wrecked, and drowned. The third was Montbar, a Frenchman, and he was stimulated by detestation of the Spanish atrocities, more than the love of plunder, and was, by the Spaniards, called the exterminator, for he never spared them, and never relaxed in his enterprizes. The next was L' Olonois, who, in like manner, carried on an exterminating war, in which he attacked the Spaniards in their forts and towns, till he was killed. The last was Morgan, commonly called Sir Henry, and he contrived to organize an immense piratical force, taking Porto-Bello, and marching with a land-force, and taking Panama, which he burnt. Their prize-money was so considerable, that desperate adventurers joined them from all parts of Europe, and they became as terrible in the Peruvian Seas as in the Mexican; but, in the beginning of the last century, the maritime powers found it their common interest to put them down, for the commerce of all countries suffered by the Spaniards in their defence, as well as from the Buccaniers, who did not confine their attacks to Spanish vessels, when a rich prize offered.

The Succession War, from 1702 to 1713, arose out of a question whether an Austrian or a French prince, grandson of Louis XIV., should succeed to the throne of Spain. Our William III. organized a confederacy to oppose Louis, but, after obtaining great victories at Blenheim, &c. &c., the Allies withdrew one after another, and the French prince succeeded.

The first European settlement in Virginia was made in 1607; at New

York, in 1609; and, in Massachusetts, in 1620.

The Battle of Bunker's Hill, or Breed's Hill, took place June 17, 1775. On October 11, 1777, Burgoyne surrendered. October 19, 1781, Cornwallis surrendered. On November 30, 1782, the independence was acknowledged.

On March 4, 1789, Washington became president. In 1797, J. Adams. In 1801, T. Jefferson. In 1809, James Madison. In 1817, James Monroe. In 1825, J. Q. Adams. In 1829, A. Jackson.

Penn's charter was dated March 4, 1681; and his first colony was 500 persons.

The Cape of Good Hope and the Canary Islands were discovered about	1405
Madeira was discovered in	1420
The Cape de Verd Islands	1474
The Bahamas, Hispaniola, and Cuba, by Columbus	1492
The Continent of America, by ditto.	1494
Brazil	1500
Ceylon	1506
Madagascar	1507
New Spain, and the Straits of Magellan	1518
The first voyage round the world was completed in	1522
Japan was discovered	1542
California	1543
Virginia colonized by Ralcigh	1584
Falkland Islands	1592
Hudson's Bay	1610
Louisiana	1633
Otaheite, &c.	1767

In 1804, Napoleon had assembled 160,000 men, 10,000 horses, 17,000 sailors, and a flotilla of 1300 vessels, to invade England, from Boulogne, Wimereux, and Ambleteuse, and the expedition was baffled by Admiral Villeneuve sailing to the West Indies, instead of entering the channel. The English Government subsidized Austria and Russia, and the army of Boulogne conquered Austria, and gained the victory over both at Austerlitz. The coasts of Kent and Sussex were also lined with martello towers and lines of defence, and nearly half the population formed volunteer corps. The question was the evacuation of Malta, agreeably to the treaty of Amiens.

The Battle of Leipsic, fought in 1813, was lost by Napoleon, owing to a body of 30,000 Saxon allies turning on the French, in the heat of the battle.

The Battle of Waterloo was continued till night, by the arrival of 40,000 Prussians, under Bulow, about 4 o'clock, and was gained by a flank assault of 10,000 fresh Prussian cavalry, under Blucher on the right of the French army, at 8 in the evening. The battle was fought on the position of the combined army, which was a plain, with a valley in front; and their two advanced positions, in the valley, were a farm-house, and enclosed yard by the road side, called *La Haye Sainte*, in the centre; and a chateau, with an enclosed garden and orchard wall, called *Hougomont*, to the right. These, containing picked regiments, were taken by assault, with terrible mutual slaughter, but Hougomont was afterwards burnt by Congreve rockets. The battle then took place on the ascents from the valley, and on the plain above, till the arrival of Blucher's cavalry, who, galloping through the valley, took La Haye Sainte, and placed the French on the heights between two fires.

The year 1830 was remarkable for three revolutions, that in France, July 27th, when Charles X. was expelled, and a constitutional Government formed by Louis Philippe, and the Chamber of Deputies; that in Belgium, in September, by which the Orange Family were driven into Holland, and a popular government established; and that in Poland, in December, by which the Russians were expelled, and a popular governmen formed.

Treaties and National Conventions in Modern History.

The Golden Bull	1356
Treaty of Troyes	1420
Pragmatick Sanction	1439
League of Cambray	1508
Edict of Worms	1521
The French League	1576
Peace of Munster	1648
——— Breda	1667
Triple Alliance	1668
Treaty of Nimeguen	1678
League of Augsburg	1686
Treaty of Partition	1700

Methuen Treaty 1703
Treaty of Utrecht 1713
——— Aix-la Chapelle 1748
Family Compact 1761
Peace of Paris 1763
——— Versailles 1783
Treaty of Pilnitz 1791
Partition of Poland 1795
Peace of Leoben 1797
Congress of Radstadt ..... ———
Peace of Luneville 1801
——— Amiens 1802
——— Presburg 1803
Berlin Decree 1806
Peace of Tilsit 1807
Milan Decree ..... ———
Treaty of Bayonne 1808
Peace of Vienna 1809
Treaty of Paris 1814
——— Ghent ..... ———
Congress of Vienna 1815
Treaty of Paris 1817
——— Akerman 1826
——— London 1829

ARMS, CUSTOMS, &c.

The Greek Phalanx consisted of 8000 men in a square battalion, with shields joined, and spears crossing each other.

Ancient soldiers were trained to fight with either hand.

A Roman Legion consisted of 6000 men, divided into 10 cohorts, and every cohort into 6 centuries, with a vexilum, or standard, guarded by 10 men.

The Macedonian Phalanx was 16 deep, with shields joined.

Among the early Romans, commanders of armies were called *Imperatores*, but when Cæsar became Emperour, the commanders were called Dukes, or Lieutenants of Provinces.

In a Roman Army, the first line were *Hastati*, or young men; the second *Principes*, or middle aged; the third *Triarii*, or veterans. The light troops, for skirmishing, were called *Velites*. The latter had bows and slings, and seven javelins. The former, a two-edged sword, buckler, and helmet.

Attached to every Roman legion was an ala of 300 horse in 10 turmæ. The commander of the legion was a perfectus; of the cohorts, a tribune; and of the centuries, a centurian. The standard was a silver eagle, on the top of a spear.

The Greeks and Romans had no standing armies in time of peace. In war, every citizen was a soldier.

The Romans had no titles. Scipio and Cæsar were simply so called. Titles began in the Court of Constantine. The Emperour of Germany first took the title of *Majesty*. Kings, till the 15th and 16th century were called *Highness*.

The Eagle was the Imperial Symbol in Persia, Rome, and of Napoleon. It is now adopted by Austria, Prussia, and Russia.

The Romans deified their emperours, &c., by a solemn publick ceremony, called an Apotheosis, in which the priests and heads of the state assisted in great pomp.

The Romans counted by cycles of 9 days, the Greeks by 10, the Asiaticks by 7, and hence our weeks.

Roman names were Prænomens, Nomens, and Cognomens, as Caius Julius Cæsar, or Publius Cornelius Scipio.

The head of the Memnon, from Thebes, is in one entire block, measuring 10 feet from the breast to the top of the head, and weighs 12 tons.

Baiæ was the pleasure town of Rome, Daphne of Antioch, and Canopus of Alexandria, just like Brighton and Cheltenham to London, or Versailles to Paris.

The candidates for the athletick games, in Greece, used to be dieted on new cheese, dried figs, and boiled grain with warm water, and no meat. The games were leaping, foot races, darting, quoits, wrestling, and boxing.

The Romans had 327 publick granaries, from which they distributed corn to the poor, at the cost of the publick treasury; and they had no almshouses, or poor-rates. The Greeks had various charitable institutions.

The Romans lay on couches at their dining tables, on their left arms, eating with their right.

In Greece it was the custom, at meals, for the two sexes always to eat separately.

The early Romans ate boiled grain;

they had not the art of bread-making, and had no mills.

All ages have produced heroiek women, but none a nation of Amazons.

The largest battering rams of the aneients were equal in foree to a 36 lb. shot from a eannon.

Silver was first eoined by Phidon, king of Argos, about 860, the epoch of the building of Carthage, and about 140 years after the building of Solomon's temple.

Among discoveries of aneient eoins, 60,000 Roman ones were onee found at Modena. 40,000 gold Greek coins were found in a river in Transylvania. 30,000 Roman eoins were found near Brest; and 600 lbs. of silver coins were found in Sieily. Pots full are often found in Britain.

The most aneient known eoins are of the fifth eentury B. C. and are Macedonian; but others are believed to be more aneient. After that date they illustrate history, but not earlier. They are of gold, silver, eopper, or brass. Few give dates, and, therefore, they are more eurious as relieks than useful as reeords.

The most perfeet chronology is Antini's L'Art de verifier les Dates. The next is Blair's, a Seottish work; and Aspin's is a very careful eompilation.

The Jews had no ehronology. The Chinese invented their Sexagenary Cyele, in 2539 B. C., and, till then, their history was neeessarily confused. The Hindoos adopted it. Till epoehs were fixed, and eyeles invented, there was no eertain reeord of time; and henee the eonfusion of early history.

Anthropophagi, or feeders on human flesh, have existed in all ages, and still exist in Afriea, and the South Sea Islands. Diogenes asserted, that we might as well eat the flesh of men as the flesh of other animals. The Greeks inform us it was a primitive and universal eustom. Some of their gods lived on human flesh, and the Cyclops did the same. Aristotle and Herodotus name various nations who preferred human flesh to that of animals. The Giagas, and several Afriean nations, have the same preference; and we all remember the practices at Owyhee, New Zealand, &c. &c. Human flesh has the flavour of hog's-flesh, and the tenderness of the flesh of ealves.

The horrible punishment of erueifixion is still praetised in some Mahomedan eountries. The unfortunate vietims often live in torture for many days. All the eharaeters of antiquity, who are lauded in history, indulged in this superlatively barbarous praetiee. Alexander, Cæsar, Augustus, Titus, all the Roman Emperours, and the Mahomedan eonquerors often erueified their hundreds, and even thousands at a time, and women were not exempt from this fate.

The wearing of rings is very aneient. It was prohibited in Rome to all meehanicks, and men of mean eondition, to wear rings of gold, so that granting a lieense for any person to wear a ring, was as mueh as to make him a gentleman. The usage of sealing with rings is also of great antiquity.

The adoration, elaimed by aneient kings, was that of kneeling and prostrating, as praetised in many courts to this day. Alexander merely elaimed this homage after the eastern fashion; and henee the railing of the Greeks.

Amphitheatres were vast ereetions in the Roman empire to amuse, or rather brutalize, the people, and qualify them for military life by the exhibition of murderous eontests between gladiators and wild beasts. They were of an elliptieal form, and adapted for thousands of speetators, to whom earnage was made a pastime. They were invented by Julius Cæsar and Curio. Augustus caused them to be ereeted every where. In the reign of Tiberius one fell at Fidenæ, by whieh 50,000 persons were killed or wounded. Vespasian built the first of stone, the vast Coloseum for 100,000 spectators. Its longest diameter is 615.5 feet, and the other 510, eovering 5½ aeres, and being 120 feet high. It was imitated at Capua, Verona, Nismes, Autun, and Pola; while at Italiea, Alba, Otrieuli, Puzzuoli, Pœstum, Syraeuse, Corinth, Arles, Caerleon, and other places, smaller ones were eonstructed.

On the triumph of Trajan over the Daeians, 11,000 animals were killed in those at Rome; and 1000 gladiators fought during 123 days. The

gladiators at first were malefactors, who fought for victory and life; or captives and slaves, who were made to fight for freedom; but soon many lived by it as a profession, and even ladies became gladiators. They continued with modifications for above 500 years. Tilts and tournaments, with duelling, were the last remains of them.

The Babylonians worshipped fire, as the emblem of the sun. They were acquainted with geometry and mechanicks, and were perfect manufacturers, their products selling at vast prices in all countries. They professed to derive their knowledge from Oannes, who sprung from the first egg, appeared in the Red Sea, and taught letters and the sciences. Their astronomy was accurate, but subservient to astrology. They lived like the Hindoos, chiefly on vegetables, in which the country, owing to inundations, was wonderfully productive.

The oriental philosophers taught a trinity, in *Orimanes*, God; *Methra*, the Spirit; and *Arimanes*, the Devil.

The *Ancient of the Mountain* was a title assumed by the chief of a Syrian corps of assassins, in the 13th century.

The shield, the breast-plate or gorget, was extended to the body and limbs as armour, and the helmet protected the head. The most savage tribes use shields, and often helmets. Shields were usually made of leather, but often of wood or metal. The Grecian was round, the Roman square. The helmet was provided with a vizor, to raise above the eyes; and a beaver, to lower for eating. The vizor, with grated bars, is used in the arms of nobility; the elevation, without bars, a knight; and the vizor closed, an esquire. The armour, for the arms and shoulders, was called the *vambrace* and pouldron; for the thighs and legs, *cuises* and greaves; and, for the hands, *gauntlets*.—Knights wore golden spurs; squires silver ones. The armour, or mail, was called *chain*, if made of scales or net-work; or *plate*, if in small metal pieces. The Saxons and Normans used long spears. The Greeks threw theirs. Spears were 6 yards long, and pikes 14 or 15 feet. Maces were originally clubs, used by cavalry, and fixed in their saddles. The Roman swords were from 20 to 30 inches. The broad sword and cimeter has lately been adopted.

Taliesin says the *Gwyddyl*, (Celts or Gauls) *Brython*, and *Romani* had taken possession of different parts of these islands before his time.

"Gwyddl, a Brython, a Romani.
"A wana hon dyhedd, a dyfysei;
"Ae am derfyn Prydein, cain ei threfi."

Irish little resemble Welsh. The first Celts were progeny of the Titans, and their princes and nobles were Curetes and Corybantes, or Cowri, and Cowri-bann, meaning nobles; and their name Gwyddyl, is from Gwydd-trees or shrubs, or inhabitants of forests.

Aaron Raschid, in 802, sent from Bagdat, among other presents, to Charlemagne, a clock of curious workmanship.

The lands being taken by conquerors from proprietors, and given to partizans, the new occupants would have been burnt in their dwellings by the indignant people if they had been accessible. A fort, for the same reason, is the first erection of intruders in every new colony. The ancient Castle generally enclosed from 5 to 10 acres of land: and had a river or ditch, commonly filled with water. On its verge was a wall, then another wall, a space between them being called the ballium. Within the second wall were apartments and storehouses for the garrison, and a citadel, or keep, placed on a high mound for further security; and there often were subterranean secret ways. Beyond the moat was the barbican, or watch-tower, and from it, across the moat, was a drawbridge raised inwardly. The entrance through the ballium was secured by gates, with a ponderous grating, or porteullis, which was raised or let down by iron chains running over pulleys. The walls were further protected by battlements and towers, and by loop-holes, to fire arrows through. All the walls were 8 or 10 feet thick, but those of the keep were 15 or 20; and, without artillery, they seemed unapproachable, and likely to surrender only from want of provisions. In

some secure part, there were vaults for the security of prisoners. Probably some of them were first constructed by the Romans, and others in the time of Alfred; but the system in England was carried to perfection by the Normans.

Archers were a formidable part of all ancient armies, and the use of the bow seems to have been known to all nations, when first discovered. The Scythians were the best ancient archers, and the English among the moderns. The victories of Cressy, Poictiers, and Agincourt were chiefly gained by the English archers. Robin Hood shot a full mile; and, according to his bard, a north-country mile was equal to two statute ones. The Scythian bow was of horn. The English long-bow was 5 feet 6, and they were made of steel and brass. Arrows were from 3 to 5 feet. Ash was used by the English, and goose feathered, two of the fledges white and one black. The heads were iron or brass, with light steel points, and small barbs. The strings were of gut, or hide, or hemp. A sheaf of arrows was 24; and the archer was armed with a maul and a dagger. The English archers drew to the ear steadily. A furlong was the distance of the butt, in shooting at marks. The Parthians, and other nations, had horse archers.

The usual range of the long-bow was from 3000 to 4000 yards. Robin Hood and Little John shot twice that distance. They could shoot six arrows in two minutes. The length of the bow was six feet, of the arrow two or three. They were of yew or ash. Cross-bows were fixed to a stock of iron or wood. It was bent by a lever, and its two strings were discharged by a trigger. It threw bullets and stones, as well as arrows. Its range was 150 yards.

Among the ancients the balista discharged stones, and the catapulta arrows. They were equivalent to artillery. The catapulta threw arrows half a mile, and the balista, stones of 200 or 300 weight.

The mark used by archers, in trials of skill, was called a popinjay, because like a parrot. Archers used long bows, of yew or steel; others were cross-bow-men, who fired quarrels, or darts and stones. Bowyers made bows, and fletchers arrows and darts.

The composition of gunpowder is said to be concealed in the works of Roger Bacon; and he had correct notions of the radiation of light, if he did not invent spectacles. His reasoning powers did not, however, enable him to discard the elixir vitæ, the philosopher's stone, and astrology.

Robins says, that no field-piece should be loaded with more powder than a fifth or sixth weight of its ball; nor any battering-piece with more than a third.

The velocity of the explosion of gunpowder, fired alone from a cannon, is 7000 feet per second; and, at the moment of explosion, four times greater. Cannon-balls go farthest at an elevation of 30°, and less as the ball is less.

Cannon were used at Quesnoy, or Cressy, perhaps before, and called *bumbards*.

The largest known piece of ordinance is of brass, cast in 1685, at Beijapour, by Aulem Geer. It is 14 feet 1 inch long, and 28 inches bore, and equal to a ball of 2600 lbs.

13-inch mortars range 2½ miles, and weigh 82 cwt., are 5 feet 3 inches long, and take a charge of from 20 to 30 lbs. of powder; 10 inch range 2 miles; and 8-inch, 1 mile, 2 feet 1 inch long, with 2 lb. 2 oz. of powder; 13-inch, in the land-service, are 3 feet 8 inches long, with 9 lb. 1 oz. of powder; 68 lb. shot are 8 inches in diameter, with 9 lb. of powder, and bore 4 inches; a 13-inch shell weighs 198 lbs., and is charged with 6¾ lbs., of powder.

The Shrapnel shell is a bomb filled with balls, and a lighted fuse to make it explode before it reaches the enemy, when the bullets separate, and proceed as before.

The range of carcasses is about two miles, and those of 13-inch diameter require about 30 lbs. of powder.

The famous floating batteries with which Gibraltar was attacked in 1782 were the scheme of D'Arcon, a French engineer. There were 10 of them, and they resisted the heaviest shells and 22-pound shot, but ultimately yielded to red-hot shot.

Rifle barrels make the ball pass through a screw, formed in the length of the barrel, by which the velocity, at exit, is increased, and the aim is more true.

Muskets have, till lately, borne the ancient names of hand-guns, alivers, hackbuts, harquebusses, match-locks, and fire-locks. Within 120 years they were discharged with a match.

Perkins's steam-artillery is to throw 60 balls, of 4 lbs., per minute; and from 100 to 1000 musket balls per minute.

In modern tacticks, the hollow square is preferred to the solid squares of the ancients, when infantry are attacked by cavalry.

We cannot wonder that *kings* so readily cause men to be killed, when it appears, on authority, that Charles the Tenth, in a single year gratified his *royal* taste by 89 stag-hunts, and by shooting 3525 pheasants, 1375 partridges, 555 hares, and 1532 rabbits. In all, this royal exemplar destroyed, in one year, 7404 animals, most of them more worthy to live than himself; while his precious son, the Dauphin, claimed his 7025, including more pheasants and hares than his father. In one year, 1828-9, there were killed, in France, 834 wolves and cubs.

The European nations have had in service the following armies:—Russia and Austria, 500,000 each; Prussia, 350,000; Great Britain, 300,000; France, 650,000; Spain, 150,000; Holland, 50,000; Bavaria, 50,000; Turkey, 450,000; Sweden and Naples, 40,000; Denmark, Portugal, &c. 25,000. each.

It is estimated that, in the last 4000 years, the following number of the human race have perished by violent deaths in the field of battle, or have been slaughtered in the sacking of cities: During the time of

Bacchus, &c. . . .	*Millions* 15
Sesostris	15
Semiramis	10
Cyrus	10
Cambyses, &c. . . .	25
Alexander	10
His Successors . . .	20
Jewish Wars . . .	25
Romans before Cæsar . .	60
Grecian Wars . . .	15
Other Ancients . . .	25
Twelve Cæsars . . .	30
Roman Empire . . .	60
Northern Nations . . .	50
Middle Ages	40
Crusades	40
Saracens	60
Reformation	30
Tartars	80
Turks	60
Chinese	100
French Revolution . .	60
American Wars . . .	40
African Wars	100
Killed in Battle, &c. . .	980
Severely Wounded . .	2940
Famine and Suffering . .	2940
Millions . . .	6860

At the rate, in 4000 years, of 1,715,000 per annum; or seven times the present number of the species.

*** *For other facts in history, and for numerous dates in relation to all kinds of events, please to consult the articles* BIOGRAPHY *and* CHRONOLOGY.

BUILDING AND ARCHITECTURE.

THE *Cyclopean Style*, from its extraordinary magnitude, is ascribed to the early Cyclops, men, who, from their power, prowess, and mighty works, are believed to have been the Giants and Titans of the Septuagint version of Isaiah; and whose deceased monarchs became afterwards the sovereign Gods of Greece and Rome. The general character of the Cyclopean style was immense blocks without cement, though the walls are now irregular, from smaller stones, which filled up the interstices, having disappeared. Hamilton divides the style into four eras:—The *first*, or oldest, is that used at Tiryns and Mycenæ, consisting of blocks of various sizes, of which the interstices are or were filled up with small stones. The *second* era as at Iulis and Delphi, is marked by polygonal stones, which nevertheless fit into each other with great nicety. In this style there are no courses. The *third* style, as in the Phocian cities, and in some of Bœotia and Argolis, was distinguished by the work being made in

courses, and the stones, though of unequal size, being of the same height. The *fourth* and youngest style, presents horizontal courses of masonry, not always of the same height, but formed of stones, which were all rectangular. This style was chiefly confined to Attica. Pliny says, that the Cyclops were the *inventors* of the fortifications of towns, and also of towers. Sir William Gell adds, that Tiryns is the best specimen of the military architecture of the heroick ages. Homer calls it the well-walled Tirynthus, so that there cannot be a doubt but that the present ruins are those of the citadel, which existed in the time of the poet, and was built about 1379 before Christ, by Prætus.—*Fosbrooke.*

The Gate of the Lions, at Mycenæ, is Cyclopean. Euripides calls Mycenæ a Cyclopean city; and Homer mentions it among those which were fortified before the Trojan war. Apollodorus says, that Perseus fortified Tiryns and Mycenæ. The Gate of the Lions, says Pausanias, is said to be the work of the Cyclops, who built the walls of Tiryns for Prætus. And the lions are the only existing specimen of the sculpture of the heroick ages. They have not the tails of lions, a circumstance observable also in the sculptures of Persepolis, where animals very like those of Mycenæ are represented, as well as lions, who have the tail natural to their species. The Cyclops were worshippers of fire, Vulcan, and the Sun; and the lion may have been the national symbol.

The Cyclopean gate of Mycenæ affords a perfect commentary upon passages of scripture. The markets were held in these places: "And here," says Dr. Clarke, "we see the origin of the vicinity between the forum, senate-house, and basilica." "Either the Britons," says Dr. Fosbrook, "invented modes of fortification for themselves, or copied from others." That the Cyclops were Celts is certain; and it appears that the postern gate of Mycenæ is in the form of one of the Trilithons of Stonehenge; and that the Cyclops worshipped the Sun, whose temple in Britain, mentioned by Diodorus, is that celebrated remain. The Acropolis of Mycenæ is marked by terraces, which wind up a hill, and were defended by walls, square towers being placed at the angles, and at the distance of about every 50 feet in the straight walls. Trer Caeri, the most perfect of the British fortresses, is in like manner a hill terraced and hooped with walls; and the Little Doward, near Monmouth, has the winding ascent, and earthworks of foundations at top, similar to Mycenæ. The ancient Irish fort, called *Horsleap*, is also a succession of terraces. The Cyclopean masonry was not, however, limited to Greece. Two fine specimens occur in Italy, at Ansidonia and Saturnia, towns anteriour to Rome, and at the Old Lycosures in Arcadia, whence issued all the colonies of Italy. We may see the religious style of architecture, belonging to the Cyclopean age, in the fine remains at Salset, Elephanta, Canora, and Illoura. They are caverns cut out in the body of a rocky hill, and shaped into courts, supported by parts of the rock, formed into columns at Elephanta, with cushion-like capitals. The sides are filled with bas-reliefs, so prominent that they are joined to the rock only by the back. Many of the figures are colossal.

Egyptian architecture astonishes by massy grandeur. It simply consists of enormous blocks, thick columns, walls narrowing upwards, with immense impending cornices, but no pediments, because, as it never rains in Egypt, there was no necessity for these, or roofs. It improved the Cyclopean.

The earliest Egyptian column was simply a stalk of the lotus, topped by its calix. The lotus is the ornament which reigned every where; and it is interlaced with infinite grace in the volutes of the Ionick and Composite capitals. In short, the calix of a flower above a bundle of its stalks suggested the form of the column, base, and capital. All the ornaments are heavy in the execution, and offer no repose to the eye. The Egyptians worshipped every divinity but the graces; every thing was upon a grand scale, suited only to gods and kings. Therefore, their buildings are especially characterized by forests of columns, avenues of sphinxes, lions, or rams, all colossal; large moles, with

immense colossal statues in front of them, obelisks, gate-ways, preceded by avenues, and detached from the moles which flanked them.

Strabo thus describes an Egyptian temple: At the first entrance is a court or avenue paved with stones about 100 feet wide, and 3 or 400 feet long, sometimes more. This is called the Dromos. On each side are sphinxes in two rows, about 30 feet asunder. After this, is one or more vestibules. Next is the temple, which consists of a large court or anti-temple, and an innermost temple. The latter is not very large, and there is no sculpture in it; or, at least, if there is, it is of some beast, but never of the human figure. At the further end of the anti-temple, are a sort of wings of the height of the temple, and the walls as far distant from each other as are the breadths of the foundations of the walls of the temple, and they are so built as to incline towards each other. On these walls are cut very large figures, much like the Etruscan and Grecian works. Strabo joins with Herodotus in saying, that the Egyptians and Phœnicians were the first nations who erected temples, but the Indian caverns are justly presumed to be more ancient.

Denon gives the general plan of the great temples: 1. An avenue of sphinxes. 2. Two colossal figures on each side of a gateway, formed by immense towers of truncated pyramids, with overhanging cornices. 3. This gateway led into a court full of columns, and chambers round the walls. 4. Passing across this, the visiter comes to other courts, likewise full of columns, through gateways, ornamented with colossal figures and obelisks. 5. In the centre was the sanctuary, without light, consisting of a single excavated block. One of them, at the temple of Latona, was 71 feet broad in front, carved out of one entire stone, and roofed by another. Semiramis is said to have brought from the mountains of Arabia a rock 20 cubits broad, and 150 long. Herodotus mentions one more than 20 cubits broad and 15 long, conveyed from Elephanta by a journey of 20 days. The general rule for determining the age of Egyptian temples is their size. The smaller they are, the more ancient.

The ancient Egyptians believed that their souls, after many thousand years, would come to re-inhabit their bodies, in case these latter were preserved entire. Hence arose the embalming and the situation of the sepulchres, in places not subject to the inundation of the river. These tombs at Thebes consist of sepulchral grottoes, made in the side of a hill, from its base to within three quarters of its summit. The lowest are the best executed, and the most spacious. A door open to the east leads to a gallery supported by columns or pilasters. At the end of the gallery is a well, which leads to the catacombs, where the mummies were deposited. These walls, from 40 to 60 feet deep, abut upon long subterranean alleys, terminating in a square room, supported by pillars. In the upper gallery are bas-reliefs, or paintings on subjects relating to the funeral ceremonies; and every grotto had a ceiling painted in a fanciful manner. Every grotto communicated with the valley by a large door. This leads into a succession of galleries, with chambers on both sides. One of these contains the actual sarcophagus, in which was placed the mummy of a king. It retains its cover, upon which is the royal effigy. The grand point of notice, however, in these souterrains, is the fresco paintings. They exhibit all the arts of civilization which then existed in Egypt, such as relate to manufacture and agriculture, saddlery, carriages, pottery, counters for trade, rural employment, hunting, fishing, marches of troops, punishments in use, musical instruments, habits and furniture.

Sesostris placed in the temple of Vulcan, at Memphis, colossal figures of himself and his wife, 30 cubits high, and of his children 20.

How the Egyptians and Cyclopeans moved and formed such stupendous masses has been often a subject of doubt and admiration, but the principles of mechanicks are few and simple. Plumb-lines, and wheels and axles, and levers are mentioned in all contemporary writings.

The Pyramids of Egypt have been opened within these few years, but

without any particular discovery, besides some passages, and an empty chamber in the great Pyramid, 66 feet by 27. In an upper chamber, 36 feet by 18 and 19 high, there was found a sarcophagus. Similar chambers were found in smaller pyramids empty, but sometimes containing images and rude sculptures. Belzoni penetrated the second pyramid of Chesroes, and found a chamber, 46 feet by 16 and 24 high, with a sarcophagus, and an inscription certifying that it had been opened by Mahomet I. The great pyramid is 543 feet high, and the second, 452 feet.

The Temple of Ypsambul, in Nubia, is cut out of the solid rock, and of vast dimensions. Belzoni found in it 4 colossal figures 65 feet high, 25 feet across the shoulders, the face 7 feet and the ear above a yard.

The same English and Italian excavators also dug out the great Sphinx, and found that it was sculptured from the solid rock, the paws being put on by masonry. Since that time, Egypt has been visited by many zealous antiquarian travellers, particularly by M. Calliaud, and lastly by M. Champoillon, a gentleman who has analyzed the principles of the hieroglyphick character, so as to be able to translate them with little difficulty; and it appears, that, instead of veiling great mysteries, their contents are little more important than the tomb-stones in a country church-yard, generally certifying nothing more than the name of the constructor, and the local and temporary object for which it was set up, mixed with some trifling mythological reference.

There are 5 Grecian orders of Architecture, the Tuscan, Doriek, Ionick, Corinthian, and Composite; to which is now added, the Gothick, Oriental, Egyptian, and Chinese styles.

In the Tuscan order, the shaft is six times the diameter, and the base and capital, each, half a diameter; the whole seven diameters, and the pedestal is a fourth more, and the entablature a fifth.

The Corinthian column is 20 modules high, the entablature 5, the base 1; the capital 70 minutes.

In the Composite order, the height is 20 modules, the entablature 5, the capital 70 minutes, the base 30 minutes.

In the Dorick order, the base is 32 minutes, the pedestal 1 diameter 36 minutes, the cornice 16 minutes, the base 3 minutes, the shafts 7 diameters, the capital 30 minutes, the architrave 30, the frieze 45, and the cornice 45.

In a Doriek column, the height of the base, shaft, and capital, is 16 modules; the entablature over the capital is 4 modules, 1 for the architrave, 1½ for the frieze, and 1½ for the cornice. The base is one module, and the capital 32 minutes.

The spiral ornaments, like ram's horns, in the Ionick, Corinthian, and Composite, are called *Volutes*. Caryatydes, to support entablatures, were figures of Carian women, taken prisoners in the city of Caria, by the Athenians. Men are called Atlantides.

Ascending, the parts of a column are the plinth, the torus, the bead, the cincture, the shaft, the astragal, the colorind, the annulets, the avolo, the abacus, the fillet, the architrave, the frieze, the cornice, the listel, or uppermost projection.

Columns consist of pedestal, shaft, and capital, in the Dorick, Ionick, Corinthian, Tuscan, or Composite orders. A pillar is a detached column. A pilaster is a support in a wall, square, but in the proportion of the columns.

A minute, in architecture, is the 60th of the greatest diameter or module.

Columns, in ascending, are diminished one-sixth or 2-13ths in diameter, commencing about one-third of the height.

Egyptian modules are the height of the Ionick column, and 4½ is the entablature. The capital is 21 minutes, and the base 30 minutes. In the entablature, the architrave is 3, the frieze 3, the cornice 4.

The Saxon style is known by the circular arch, and the Gothick by the pointed arch, either single or florid.

A well-proportioned room is a breadth and a half.

Babel, or Baalbel, was a lofty temple built at Babylon, by Belus, both as an observatory, and a temple of the Sun. It remains still in existenee, under the name of Birs Nimrod, and has been amply deseribed by Rieh and Porter. It was formed of 8 square towers, one on the other, 660 feet high, and the same at eaeh side of its base. Lately its height was 160 feet, and the reeds, between every 3 or 4 layers of brick, were perfectly fresh, while the briek seems to be ealeined by fire. Babylon eontinued, for 2000 years after, to be the most splendid eity in the world, and so Alexander found it as late as 325 B. C. It deeayed on the building of Bagdat by the Caliphs, as better situated for intercourse, in 760 A. D. Aeeording to the Jewish annals, it was built 2234 B. C., beautified and enlarged in 2150, by Semiramis, who led from it her armies of all nations. The Euphrates passed through it. It was a square, 15 miles on eaeh side, with 100 brass gates. It was eomposed of 25 streets each way, 15 miles long, and 150 feet broad, crossing each other at right angles, besides 4 half-streets, 200 feet wide, faeing the walls, in detaehed houses, with gardens and pleasure-grounds. The walls were 87 feet thiek, and 370 high. So says Herodotus and other aneients, but the whole must be exaggerated, for, 15 miles eaeh way, would be 225 square miles; and London, vast as it is, does not cover above 32. It must have been equal to Middlesex, and its walls as high as St. Paul's.

The palace, the hunting gardens, the artificial lake 40 miles square and 6 fathoms deep, as well as the temple of Belus, or Baal, with a golden image, 40 feet high, valued at 3½ millions sterling, all savour of eastern exaggeration. In 540 B. C., it was besieged by Cyrus, but being provisioned for 20 years, he bloekaded it for 2 years, and then took it by fording the river during a festival of the Babylonians. In 518, under Darius, it revolted, and being retaken, its 100 gates and walls were destroyed. In 478, Xerxes, after his defeat in Greece, passed through Babylon, and, to reeruit his treasures, plundered the temple of Belus, and demolished its lofty tower. In 324, Alexander began to re-build it, and employed 10,000 men for 2 months, but his death arrested their progress. 30 years after, Seleucus built Seleueia near it, and drew off its inhabitants, so that in 650 years after, Jerome deseribes it as deserted.

The palace of the kings of Babylon is still so called by the natives, under the name of the *Kasr*. It is a vast mass, 700 yards eaeh way. The walls are 8 feet thiek, one within another, and strengthened with buttresses. There is also another extensive ruin, called *Amram*, three quarters of a mile long, and half a mile broad, which rises 50 or 60 feet above the level of the plain. A third mass is ealled the *Muljelibe*, which is considered to be the remains of the tower of Belus; the sides are from 200 to 150 yards, and the present elevation is 141 feet. The ruins are immense, eonsisting of pottery, vitrified brick, bitumen, &c. Another vast ruin or tower, six miles southwest of Hellah, is called the *Birs Nimrod*, and eonsists of a mound, 762 yards round, rising in a conieal form, 198 feet, and on its top has a solid eone of briek-work, 37 feet high. Whether this or the former is the temple of Belus, seems uncertain; near it is another mound, with traees of ruins of vast magnitude. The three former buildings are on the eastern bank, and the *Birs Nimrod* on the western side of the Euphrates.

These vast remains lie on the bank of the Euphrates, north of the village of Hellah, 9 miles from Mohawil, and 48 from Bagdat; and, for their age, are wonderfully preserved.

The walls of Babylon were 46 miles round, whieh, when the city deeayed, served as a park for hunting to the kings of Persia. The era of Nabonasser, one of the kings, was the 8th Olympiad, 6th of Rome, or 748 B. C.

Noah's Ark, taking the cubit at 22 inches, was 547 English feet long, 91 broad, and 54 high, measuring, according to Bishop Wilkins, 72,625 tons, or 20 times as much as the Hibernia.

The wall whieh separates China from Tartary, has been built full two

thousand years, and is supposed to be upwards of 1200 miles in length: its height varies according to the circumstances of the surface. Where one of us contrived to get to the top it was upwards of 30 feet high, and about 24 broad. The foundation is laid upon large square stones; the superstructure is brick; the centre is a kind of mortar, covered with flagstones. A parapet of no ordinary strength runs on each side of an embattled wall. If we consider that this immense fabrick covers the widest rivers, on arches of proportionate size, or, in the same form, connects mountains together, occasionally ascending the highest hills, or descending into the deepest vales, the most active powers of imagination will be required to realize this effort of man! In every situation, however, the passage along it is easy and uninterrupted; and it serves as a military way from one end of the kingdom to the other. At proper intervals there are strong towers placed, from whence signals are repeated, and an alarm may be communicated to the most distant parts of the empire, with the expedition of the telegraph.—*Macartney.*

Ninevah was 15 miles by 9, and 40 round, with walls 100 feet high, and thick enough for three chariots abreast.

Babylon was 60 miles within the walls, which were 75 feet thick, and 300 high, with 100 brazen gates.

The temple of Diana, at Ephesus was 425 feet long and 200 broad, with 127 columns, 60 feet high, to support the roof. It was 220 years building.

The largest of the pyramids is 481 feet high, and 693 feet on the sides; its base covers 11 acres. The stones are above 30 feet in length, and the layers are 208; 360,000 men were employed in its erection.

The labyrinth of Egypt contained 3000 chambers, and 12 halls.

Thebes, in Egypt, presents ruins 27 miles round. It had 100 gates.

Carthage was 25 miles round.

Athens was 25 miles round, and contained 25,000 citizens, and 400,000 slaves.

The temple of Delphos was so rich in donations, that it was once plundered of 10,000 talents, or 2½ millions sterling; and Nero carried from it 500 statues.

The walls of Rome were 13 miles.

The length of Solomon's Temple, built between the years 1014 and 1005, was 60 cubits, or 107 feet, the breadth 20 or 36 feet, and the height 30 or 54 feet. The porch was 20 cubits, or 36 feet long, and the breadth 10 cubits or 18 feet.

The Temple of Solomon, though extolled as one of the wonders of the ancient world, did not surpass our larger sort of private houses. The generality of the habitations then, were probably no better than what we call huts, or cottages.—*Smith's Michaelis.*

The Temple of Ephesus, in which stood a mean statue, in wood, representing a female with many paps, was dedicated to Diana, and rebuilt seven times. In 356, the day Alexander was born, it was burnt by an incendiary. To rebuild it employed 220 years. It was 425 feet long, and 225 broad, supported by 127 columns, 60 feet high, furnished by princes, and curiously sculptured, each weighing 150 tons of Parian marble. Internally it was decorated with gold, paintings, and statues by the great masters—Scopas, Apelles, Praxiteles, Parrhasius, and the female Timarete. The priests were emasculated, and the sacred virgins were of the highest birth. It was finally destroyed by the Goths in 260. The Turks, in 1300, finished the overthrow of all its edifices, and it is now deserted for Ajasoleek, two miles distant.

The Temple of Baalbeck, in Syria, was famous for its devotion to Baal, or the Sun, but is now in ruins. The outer court, covered with architectural ruins, is 180 feet in diameter. There is then a square of 350 feet, and, on its west side, six enormous columns, the peristyle of the grand temple, once 54 in number, 21 feet round, and 72 high. There is also a smaller temple, with 21 columns, 15 feet round, and 44 high. The stones of the walls are 30 feet long and 9 deep, and three are 58 feet long and 12 deep.

Catacombs are large vaults, with galleries and chambers, in which

many nations, in certain periods of their history, were accustomed to deposit the dead. The Egyptians were the most anxious on this subject, and the practice appears to have been continued by them, for at least 3 or 4000 years. They embalmed the bodies, and, under the influence of superstition, prepared them for long endurance. Their catacombs were covered with paintings in fresco, thousands of which are still as perfect and fresh as though they were painted within the passing year. M. Belzoni constructed the fac-simile of one in London of the natural size, with all its paintings, hieroglyphicks, and other appurtenances. The bodies have for the most part been displayed for various objects of avarice; and another superstition led the physicians of Europe, for several ages, to prescribe mummies as a medicinal drug. Rome also has its catacombs of vast extent; and Paris and Syracuse have others, but no mummies.

Among the Romans and the eastern nations, bathing was a constant and costly luxury, and warm bathing generally prevailed; while, to indulge in it, every refinement of architecture and ornament was exerted. The publick baths had 5 or 6 apartments for dressing and undressing, and they were called Thermæ. In Rome, there were 856 publick baths; single ones of which could accommodate 1800 persons at once. The Mahomedans consider frequent bathing as a religious duty, so that every house has its bathing apartments, and every village its publick bath. Warm and hot bathing are also very general in Russia and Hungary. All these practices are so essential to vigorous and healthy animalization, that there is wisdom in the religion that enforces them as a duty. A clean skin is as necessary to health as food, or lungs, or alvine evacuations.

Twelve great roads diverged from ancient Rome, and spread all over the empire, there being 12 branches near the city, and 18 others in Italy. Napoleon's great road over Mount Cenis declines 1 inch in 20; and that over the Simplon, made in 1805, declines 1 in 29. It has several tunnels, and the longest is about 500 feet.

The chariots of the ancients were like our one-horse chaises, or phaetons. Close carriages began to be used by persons of the highest quality in the 14th and 15th century. Paris had three in 1550, and Henry IV. one, but without straps or springs; and, in the same age, there were 36 at Warsaw, drawn by six horses. In sundry places men were forbidden to ride in them, as effeminate. They were first made in England in the reign of Elizabeth, and were then called whirlicotes. The Duke of Buckingham, in 1619, drove six horses; and the Duke of Northumberland, in rivalry, drove eight. They were first let for hire in Paris, in 1650, at the Hotel Fiacre; and hence their name. In London, they were first let for hire in 1625, and were 20 in number; in 1637, they were limited to 50; and, at the restoration, 400 were licensed. In 1830, 1200 coaches and chariots, and 200 cabriolets. In 1800, the number of four-wheeled carriages in Great Britain was 17,992: two-wheeled carriages, 14,771; and tax-carts, 16,-968.

The construction of temples was adapted by the ancients to the nature and functions of the deities. Those of Jupiter Fulminans, Cœlum, the Sun, Moon, and Deus-Fidius, were uncovered. The temples of Minerva, Mars, and Hercules, were of the Dorick order, which suited the robust virtue of these divinities. The Corinthian was employed for Venus, Flora, Proserpine, and the aquatick Nymphs. The Ionick was used in the temples of Juno, Diana and Bacchus, as a just mixture of elegance and majesty.

The first habitation of mankind were cabins, grottoes, or caves. Virgil says, that before Troy and Pergamean citadels existed, men dwelt in the bottoms of valleys. Some of these early cavern-dwellings exist at Ispica, in Sicily; and, being the works of men little removed from a state of nature, are of the most remote antiquity. Gellio, son of Cœlus, first invented mud-buildings, from a martin's nest; and Plutarch mentions cottages, as made of frame-

work and mud. Before the invention of brick-houses, by Euryalus and Hyperbius, caves were used. The flat roofs of the private buildings distinguished them from the publick edifices. All the chambers in the houses at Pompeii, and the best, those entirely painted, received light only by the doors. Neither the rooms nor houses have any kind of symmetry; even a Mosaick pavement has been seen to descend towards the door. The only house with two stories ever discovered, is at Pompeii. The stories consist of arches over each other.

The roofs of houses, among the ancients and eastern nations, are flat; and they often sleep upon them, and have gardens upon them. The Greeks gave the roof a small elevation in the middle; the Romans increased it to a fifth of the span. The Germans, and other northerns, make the roof an equilateral triangle.

Forums were places originally destined to negotiation, either of merchants or others, whose dealings took place in the open air. They were generally surrounded by a colonnade, over which was sometimes a second, for the convenience of those who wished to view the shows, for the forum was also the scene of the gladiatorial combats, before the invention of amphitheatres. Basilicæ were subsequently added, for the protection of litigants, and decision of causes under shelter. No city, however small, was without its forum. It was a market-place for all kinds of goods, whether of rusticks or citizens. Under its porticoes were exercised all sorts of trades, liberal, servile, or sordid; and within them were arranged the bankers' shops and coffee-houses. In the forum was also the senate-house, the curia for the assemblies of Augustals (similar to our common council) and priests for cognizance of sacred matters, the Comitia for assemblies of the people, the Ærarium, or Treasury, Record-office, and publick granaries.—*Fosbrooke.*

Winckelman, quoting the comedies of Plautus and Terence, observes, that Grecian doors opened outwards; so that a person leaving the house knocked first within, lest he should open the door in the face of a passenger, Hinges were not then in use; and at Rome, Pompeii, and Herculaneum, doors, even of marble, have at top and bottom pivots, which turn in sockets.

Rome was supplied with water by 13,594 pipes from the aqueducts.

Towns originally were fortresses, to which rusticks retired with their cattle, when there was danger from the incursion of enemies.

The Caaba, now the Temple of Mecca, was the ancient Temple of the Arabs, with 360 idols, one for every degree, and the statue of Hobab, with seven arrows for the planets. This worship was established by Saba, the eighth from Noah, who called himself Servant of the Sun, and was *Sabeanism*, which once extended over Asia. They built temples to the seven planets, the 12 signs, and 24 principal constellations. They reverenced the Book of Seth, who divided the zodiack, taught the aspects, assigned the virtues of the planets, &c. Job was of this country, and the chief race of their kings was called Tobba. Hence, in Job, the references to Arcturus, the Pleiades, &c. It is now called El Haram, or Inviolable. In the north-east corner is the tomb of Mahomet, surrounded by an iron-green railing, interwoven with inscriptions, in filigree of yellow bronze, of "La Illaha il Allah al hak al Mobyn," meaning "There is no God but God," in silver letters. The railing and its ornaments are so close, that there are small windows to look through. Persons of rank are permitted to go within the railing, where nothing is seen but a curtain, which covers a square building of black stones; in the interiour of which are the tombs of Mahomet, Abu Beker and Omar, the largest being Mahomet's. The coffins are below; and that of Mahomet is cased in silver, with an inscription, "In the name of God bestow mercy upon him." The stones, or tomb in the centre, have rich coverings. The curtain round them is 30 feet high, and these articles, when changed, are sent as a present to every new Grand Seignior to cover the tomb of his predecessor, and he returns new ones in exchange. On this subject how much Christian credulity, and

even philosophical credulity, have been abused by the monkish story about the loadstone, and the suspension of the coffin by one. Burckhardt, who gives the above description, says he was laughed at when he mentioned this silly legend.

The Caaba itself is a stone edifice in the temple, of extreme antiquity, and held in such sanctity that the Mahometans, in their prayers always direct their faces towards it. The floor is raised six feet, and a door and window admit light. They say it was built by Adam, and rebuilt by Abraham and Ishmael; and they show the place where he stood, now enclosed with iron; also the tomb of Ishmael, and a black stone, given by Gabriel to Mahomet. Every Mussulman must once visit the Caaba, and, in consequence, thousands of pilgrims visit it annually. The ceremonies are, walking seven times round the Caaba, kissing the black stone, &c. &c.; ceremonies used for ages before Mahomet by the Sabeans, but enjoined by him.

Barrow is the name of those circular mounds found in Britain and other countries, to record a burial on the spot. Their size is supposed to be proportioned to the rank and means of the party. The Kings of Egypt built pyramids. The largest in England is that of Silbury-hill, near Marlborough; in Scotland, they are called Cairns; and, in England, they have sunk to the modest grave. The Greeks made large barrows; but the largest, next to the pyramids, are those of the Kings of Lydia. One of these is three-quarters of a mile round. Even the savages in America erect similar monuments, and some of great size. In Scotland and Wales they are often made of stones; and the Jews had a custom of the kind. Those which have been opened in England contained skeletons, urns, and warlike implements. It has been supposed, that they were so placed as to serve as signal stations; but, perhaps, some of these may have been beacons, and not barrows.

Barrows are the most ancient sepulchres; but, lest the relicks should be violated by enemies, the custom of burning the dead commenced with Sylla, and did not fall into disuse till the time of Macrobius.

Sir Richard Hoare caused several barrows, near Stonehenge, to be opened in 1808. In them were found a number of curious remains of Cambrian ornaments, such as beads, buckles, and brooches, in amber, wood, and gold.

Adrian's wall, from the Forth to the Clyde, was built in 120, of turf. Antonius, another, in 140; and Severus, one of Stone, in 208. It had a ditch to the north 40 feet wide, and 20 deep, and the wall was 20 feet high and 24 thick. It extended 36½ miles, and joined 21 Roman forts.

The Picts' wall extends from Newcastle to Bowness, on the Solway Firth. It was originally of turf; but, in 416, was rebuilt of stone.

Caer-leon, or Caer-Llion, near Newport, in Monmouthshire, was, beyond question, a British city of considerable size and splendour. It is now reduced to a few houses; but the vicinity is covered with foundations, and the plough turns up numerous antiquities of all ages.

There are two periods in British architecture:—1. the Cyclopean; 2. the Roman. Of the former style, Stonehenge is the chief existing monument; and there can be little doubt but that this circle is the Temple of the Sun in Britain, mentioned by Diodorus. It is circular, as were all Temples of the Sun and Vesta. The adytum, or sanctum sanctorum, is oval, representing the mundane egg, after the manner that all those adyta, in which the sacred fire perpetually blazed, were constantly fabricated. The situation is fixed astronomically; the grand entrance, and that of Abury, being placed exactly north-east, as all the gates or portals of the ancient cavern temples were, especially those dedicated to Mithra, the Sun. The number of stones and uprights in the outward circles, making together exactly sixty, plainly alludes to that peculiar and prominent feature of Asiatick astronomy, the sexagenary cycle; while the number of stones, forming the minor cycle of the cove, being exactly 19, displays to us the famous Metonick, or rather Indian cycle; and that of 30 repeatedly occurring, the number of degrees in the signs of the Zodiack. Further, the temple being uncovered

proves it to have been erected full 500 years before Christ, before the age of Zoroaster, who first covered in the Persian temples. Finally the heads and horns of oxen and other animals, found buried in the spot, prove that the sanguinary rites, peculiar to the solar superstition, were actually practised within the bounds of this hallowed circle. The present Stonehenge was, no doubt, revived by Ambrosius about 460.

A green walk surrounds Stonehenge, made on purpose for the *Deasnil*, or going three times round it, a druidical custom, afterwards practised in Ireland even with regard to Christian churches.

There seems little reason to think but that stone circles were Cyclopean Temples of the Sun, founded before the invention of the orders; and, like all temples, used for publick purposes when necessary.

Cromlechs, or large stones, placed in the fashion of a table, but in an inclining position, upon others smaller, with or without stone circles annexed, are generally deemed altar-stones.

Rocking-stones are supposed to have been used in divination, the vibrations determining the oracle.

Diodorus Siculus speaks of the houses of the Britons as built of wood, the walls made of stakes and wattling, like hurdles, and thatched with either reeds or straw. (Wattled chimneys still occur in Wales.) Afterwards the dwellings were improved. Some set up strong stakes in the banks of earth, as well as large stones, rudely laid on each other without mortar. Strabo says, that the fashion was round, with a high-pointed covering at top; and Cæsar, that they resembled the Gaulish houses, and were only lighted by the door. That this was perfectly correct appears from the representations of them on the Antonine column, where they are either cylinders, with an arched lofty entrance, single or double, or exact fac-similes of great tea-canisters in grocers' shops; the orifice, where the lid shuts, being (according to Henry) for emission of smoke. Strutt says, that they were built at some distance from each other, not in streets, generally on the banks of a river for water, or in woods, &c. where forage might be found for the cattle. The prince chose the most convenient, and his followers erected theirs around, as well as stalls for the cattle; a ditch and mound of earth, or rampart, surrounded the whole.

Sammes, speaking of the first church of Glastonbury, says thus: "The walls of the church were made of twigs, winded and twisted together, after the ancient custome, in which kings' palaces were used to be built. So the King of *Wales*, by name Heolus Wha, in the year 940, built a house of white twigs, to retire into when he came a hunting into South Wales; therefore it was called Ty Guyn, that is, the *White House*, for he caused the twigs to be barkt. Castles themselves, in those daies, were framed of the same materials, and weaved together; for thus writes *Giraldus Cambrensis*, of *Pembroke Castle; Arnulphus de Montgomery* (saith he), *in the daies of King* Henry *the first, built that small castle of twigs and slight turf.*" Such *reed houses* as these we see in *Ireland*, and in many places in England.

As to the second period, the Romanized Britons in the time of Constantine, were builders of the best description, and built houses, temples, courts, and market-places in the towns, with every Roman accompaniment of Mosaick pavements, saloons, and porticoes.

British Castles were strong, fortified, very tall houses, built upon the top of a hill or mount, with gates and walls, both of brick and stone.

The Anglo-Saxon Castles consisted of a round or square tower-keep, ascended by a direct flight of steps in front.

The Danish Castles had round keeps upon conical hills, of clay, lime, or stone. The *fossatum* was generally a conical rising ground. The first entrenchment was made round the top, and the earth thrown round the hill. On the side of the fort which was lowest, they raised terraces and artificial banks.

Norman Castles were Anglo-Saxon, enlarged and improved into a *Gundulf Keep*, like that of Rochester, built by Bishop Gundulf, an eminent

architect. It was entered by a grand staircase, which went partly round two of the outside fronts of the castle, and ended in a grand portal, before which was a drawbridge. On the floor where was the principal entrance, there were no windows or lights whatever; not even loop-holes on the same side as the entrance and top of the staircase. The extreme inconvenience of including the offices of a large establishment in the narrow dimensions of a single tower, rendered it either habitable only as a temporary thing under warfare, or with adjuncts, as kitchens, suites of rooms, &c. The garrison, after defending the walls, upon their demolition fled to the keep. Hence old keeps were surrounded with a court of high walls, furnished with angular towers; and one of the corner towers was made of the strength and fashion of a keep.

Castles were divided into single, double, or treble, according to the ditches; and these ditches, of course, regulated the number of bridges. High artificial mounts are not indispensable of Norman keeps. The gate-house had sometimes no less than three gates and two portcullises. Above the gateway was the guard-room, with a windlass for winding up the portcullis; and beneath it, a dungeon for imprisoning offenders. From the gate-house, a communication, within the wall, only wide enough for one man to pass, went round the whole fabrick.

A postern is a door into the ditch of a fortification. The garrison and servants slept upon trusses of straw, and were crowded together without any external communication with light or air. The towers, in which the ladies resided, were very obscure and safe; and they and prisoners of war took airings upon the leads. The sentinels on castle-ward had a horn, and watched both day and night, crying, upon alarm, "Treason." At night a guard was kept by listening, and even circumambulation of patroles. Under expectation of a siege, the gates were stopped up with casks filled with earth. All the horses were sent away, the dogs killed, the women and children lodged in the church, and the houses near the walls pulled down and covered with earth, to guard against the cannon. Archers, mixed with cross-bow-men and men-at-arms, were posted upon the gates and ramparts

The fortified castles, with which England was covered, previous to the order of the long parliament for their destruction, were chiefly built between the time of the conquest and the reign of Edward III. It is said, that, in Stephen's reign, between 80 and 90 years after the conquest, no less than 1115 had been built. They were places of security, in which the Norman usurpers and baronial oppressors might insult the people with impunity; and the same thing was done in Ireland so late as the age of Charles I.

Stone buildings, says William of Malmsbury, were deemed miraculous by the Britons, as thatched and wattled work obtained among them.

The Lancet arch is the oldest form of arch known in the east; and the *Ogee*, or pointed arch, with convex curvatures, is also common and ancient in the east. The lancet arch is also seen in aqueducts built by Trajan. Columns and intersecting arches (found in France at the end of the eighth century, and common here in the twelfth), occur in a Roman pavement found at Louth. The flat-pointed arch of the 15th century is twice seen at Pompeii, as well as the reeded column.—*Fosbrooke.*

Ancient Chinese bridges, of great magnitude, are built with stone arches, exactly like those which have been considered as a Roman invention.

The pointed arch appears, but not as a fashion, so early as the reign of Edgar. About the reign of Henry II. occur the pointed obtuse arch, and round the arch often intermixed or alternate.

In the beginning of the 13th century, the Gothick style seems to have been completely established. In this early style, the arches differed very much, but were usually sharply pointed; the windows long, narrow, and lancet-shaped, and frequently decorated in the inside, and sometimes on the outside also, with slender shafts, frequently with fasciæ round them, and the capitals with foliage.—*Lysons.*

The naves of churches were not always paved, whence the use of rushes, for warmth and better kneeling. Men used to stand on the right hand, or south side; women on the left, or north.

The nimbus, or glory, drawn by painters round the heads of saints, &c. was first used by the Cæsars and their flatterers.

Church-towers were originally parochial fortresses.

Monasteries had appendages to their churches of various kinds, as cloisters, the general resort of the monks, furnished with carrels, or pews for writing, and lavatories, where they washed; refectories, or fratries, large wainscoted halls, with a crucifixion above the boards, a dresser, almories or cupboards, windows opening into the kitchen, through which the meal was served, and desk with a Bible for reading during the dinner. Chapter-rooms, with rows of stone benches, one above another, a crucifix, a reading desk and bench, and higher seat for the abbot: Dormitories, long rooms, with wainscoted partitions for each bed, to every one a window, and in each window a desk to support their books.—*Fosbrooke.*

Stone crosses owed their origin to marking the druid stones with crosses, in order to change the worship without breaking the prejudice.

Timber, with lath and plaster, and thatch for the roofs, constituted the chief materials in the dwellings of the English from an early period till near the close of the 14th century and beginning of the 15th, when bricks began to be used in the better sort of houses.

The Britons had no bedrooms, but, according to the customs of the ancient Welch and Highlanders, slept on the floor on mats, in one common room. The bed-rooms and upper chambers of the Anglo-Saxons were vaulted, bolted, furnished with a chest and a round back chair by the side of the bed, adorned with silk palls and hangings.

Fire-places were arched hearths among the Anglo-Saxons. Mediastini were fire-places in the centre, and holes for the escape of smoke. At Cheveley-park, Cambridgeshire, is a fire-place in the form of pantiles. Reredosses, and chafing-dishes, were most usual till the general use of chimneys. Leland, speaking of Bolton Castle, built temp. Richard II. says, "one thynge I much notyd in the haulle of Bolton; how chimneys were conveyed by tunnels made on the syds of the wauls betwyxt the lights in the hawle; and by this means, and by no covere, is the smoke of the harthe in the hawls wonder strangely convayed."

Transparent windows were, in the time of Seneca, quite novel. Stubbs ascribes the introduction of stone and glass windows in England to Wulfrid, Bishop of Worcester, in 736.

Bow-bridge, built 1118, is the first in England of stone; but those of wood, fortified with planks and merlined, were common.

MODERN BUILDINGS AND MISCELLANEOUS ESTABLISHMENTS.

The first dwellings of mankind were natural caves, excavations in rocks, or holes in the ground, such as are now found in savage countries. The first structures were of wood and clay, then of rough stones, and, finally, of dried and burnt bricks. When building became a separate employment, ornaments and taste arose, in which every people pursued different systems. In Syria and Asia the oldest fashions still prevail. In the extensive city of Damascus, for example, the houses are of the colour of clay, resembling the meanest cottages in Britain, and built after the form of those at Jerusalem, of the most perishable materials, viz. bricks which have been dried not by fire, but the heat of the sun. During wet weather, the slough arising from them renders the streets almost impassable. Few of the houses have floors of wood. In building, the plan is to fix nails or pins of wood in the walls while still soft, to suspend domestick articles, since they are too frail to permit the operation of a hammer. There are few windows. The houses are flat on the roof like a terrace, which is spread over with a kind of plaster, and

made firm with a roller. Many of these are surrounded with mud-walls or battlements, four feet high, to prevent accidents. Several domestick offices are performed on these roofs, such as drying linen, flax, &c. Indeed, a person disposed to make his escape from any pursuit, might, by stepping from house to house, reach the walls of the city. The apartments in houses of a superiour class are in the back part, where the inmates are in a state of complete seclusion. There is a large quadrangular court, finely paved with marble, ornamented with plants and fountains of water. During great heats, a kind of awning, or veil, is spread over the top of these courts. The floors of the apartments are covered with carpets, with large couches like woolsacks, and pillows, where the Turks are seen reclining at their ease, smoking and indulging in every gratification. In front of the streets the houses have few or no windows, but appear like blank walls, similar to those in Jerusalem, in which there is a gate or wicket, so small as to require those who enter to stoop very low. They are secured with wooden bolts, and keys of the same form as those at Jerusalem. In Persia, &c. the houses in towns have flat roofs, with gardens on them, sleeping places, &c.

The Japanese build upon one floor, and their rooms are parted by their folding-screens, so that they can enlarge or contract them at pleasure.

John-o'-Groat's house, in Caithness, the most northern part of Britain, is celebrated from that circumstance, and from its being an octagon shape, with a large table in the centre to accommodate the eight branches of the builder's family, and prevent disputes about the upper and lower end, there being also a door leading to each side.

The Needle of Cleopatra, and Pompey's Pillar, are colossal objects, which have been celebrated for ages, and excited just admiration for exquisite workmanship and antiquity, and formed one solid block of red granite, originally conveyed from the quarries in Upper Egypt, near the cataracts, and situated close to the shore. They are each about 70 feet in height, from 180 to 190 tons in weight, and upwards of seven feet square at the base. The four sides are richly adorned with hieroglyphicks, sculptured one inch in depth.

Among the splendid tombs, in Agra, is that of the wife of Sha-gehan, which employed 20,000 artists and workmen for 22 years. It is of black and white marble, and has three platforms, with four towers, and a magnificent dome.

The Theatres of Paris, in 1829, yielded 6,159,703 francs, about 250,000*l.* sterling, or 800*l.* per night in 13 theatres. The proportional receipts of the Opera Comique were 7.6. Equestrian Theatre, 6.5. Academy of Musick, Theatre Français and Varieties, and Theatre de Madame, each 6. The Government for Publick Instruction and Morals, grants one million of francs to the Opera, and 540,000 to four others.

Two London Theatres Royal received 300*l.* per night for 200 nights, or 60,000*l.* The Opera, 50 nights, 800*l.*, or 40,000*l.*; and eight minor Theatres, for 200 nights, 150*l.* each, or 300,000*l.*

The Boxes of Drury-lane Theatre hold 1200 auditors; the pit, 860; the first gallery, 480; and the second 280; making, with performers, &c. 3000 in a full theatre.

The Italian Opera-house, London, will hold 1500*l.*

Drury-lane and Covent-garden Theatres, previously to 1790, held 400*l.* Since then they have been enlarged, so as to hold from 550*l.* to 600*l.* A third of the box audience consists of free admissions or orders. Pantomime and show-pieces, in the time of Garrick and Rich, cost from 2 to 3000*l.*; and latterly they have cost more, but pay best.

The Seraglio, at Constantinople, is on the eastern point. The area is 150 acres, enclosed with high walls. The entrance from the west is called the Sublime Porte, a name frequently given to the whole government. The second gate is called the Gate of Happiness, and in its splendid buildings are lodged from 5 to 600 females, guarded by eunuchs. There is also an old seraglio in the centre of the city, where are kept the wives and concubines of former sultans. At a short distance from the Sub-

lime Porte stands the ancient Christian Church of St. Sophia, built by Justinian; and since the Mahometan conquest, in 1453, used as an imperial mosque. It abounds in curiosities. Its length is 269 feet, and its breadth 243 feet. Six of its pillars are of green jasper, from the Temple of Diana, at Ephesus; and eight of porphyry, from the Temple of the Sun, at Rome.

The country residence of the Russian sovereigns is 22 wersts, on the road to Novogorod, and is called the Czarskoselo. It is a large and very splendid palace, where the imperial family have resided for the last 70 years.

The Vatican, a magnificent palace, in Rome, is said to consist of 7000 rooms. It is advantageously situated on an eminence, one of the seven hills on which ancient Rome was built. The parts the most admired are, the grand staircase, the pope's apartments; and, above all, the vatican library, so beautiful a fabrick, that it is said it will admit of no improvement, and also the richest in the world, both in printed books and manuscripts.

The New Palace, in St. James's Park, was estimated at 432,926*l.* 450,000*l.* was granted, in 1824-5, for repairing and improving Windsor Castle, one of the noblest royal palaces in Europe.

But the most superb palace in Europe is that of VERSAILLES, about 12 miles from Paris, built by Louis XIV.; and next to it are the series of Parisian Palaces, the Louvre and the Thuilleries, all of vast extent and splendour.

Aranjuez is a palace of the Kings of Spain, 20 miles from Madrid. Its gardens are watered by the Tagus, and are very fine.

Lighthouses were erected by all ancient commercial people, and called *Tors*, or pillars, as those of Hercules, near Gibraltar; that of Pharos, at Alexandria, 550 feet high, and visible 42 miles; the Colossus, at Rhodes; the Pharos, of Messina, &c.

WORKS OF ART.

The principal painters of the Venetian School were—Titian, Georgione, Paulo Veronese, Tintoret, and Bassano. The Bolognese School consisted of the Caraccis, Domenichino, and their disciples. The chief Flemish Painters were Rubens, Vandyke, Rembrandt, Teniers, Vangoyen, Ruysdael, and Vanderneer.

The Founders of the British School were Thornhill, Richardson, Hogarth, Wilson, Gainsborough, Reynolds, Barry, and West.

The Artists of the French School were Poussin, Claude Lorraine, Vernet, and David.

The two great Painters of the Spanish School are Murillo and Velasquez.

The earliest known Painters are Cimabue, Chirlandao, Massacio Quintin Matys, and Albert Durer.

The greatest Painters, in order, were Raphael, Michael Angelo, Corregio, Leonardo da Vinci, Titian, Guido, Rubens, Rembrandt, Vandyke, Teniers, Murillo, Carracci, Claude, N. Poussin, and Carlo Dolce.

The oldest known painting is a Madonna and Child, in 886. The oldest known paintings, in England, are the portrait of Chaucer, painted on pannel about 1390, and that of Henry IV., in 1405.

The English Painters, in the order of genius, are Hogarth, Wilson, Gainsborough, Lawrence, West, Reynolds, Martin, Turner, and Wilkie.

The Royal Academy was established in 1768, and consists of a president, 5 professors, 3 secretaries, 37 academicians, 17 associates, and 6 associate engravers. Their annual exhibition contains about 1300 subjects, and yields about 2000*l.* or 2500*l.*

The British Institution for the Fine Arts, in Pall-mall, was established in 1805.

There are also Royal Academies at Dublin and Edinburgh; and Associations for Exhibitions at Liverpool, Birmingham, Leeds, &c. &c.

London has a National Gallery of Master-pieces of all the Schools, and greatest artists in each. The pictures of Mr. Angerstein were its founda-

tion; and many others have been added since of great value.

There are two funds for artists.

The Panorama, invented by Barker, is generally about 60 feet in diameter.

Albert Durer etched some of his engravings on steel. A soft steel plate will take 20,000 good impressions, and a hard steel plate 100,000.

There were in London, in 1818, painters, 532; sculptors, 45; architects, 149; engravers, 2060; and they are, in 1831, 10 per cent. more.

Painting in oil, distemper, or water is when the colours are mixed with oil, size, or water. Fresco is on a newly-plastered wall. Encaustick, is with wax; and enamel, with mineral colours, on metal.

Varnish, for oil-paintings, is mastich, dissolved in spirits of wine. For other purposes, it is copal in spirits of turpentine, &c. The one may be rubbed off with the finger, as a white powder, the other not.

Androides, to perform human actions, have been made in all ages. Bacon made one to speak; and Albertus Magnus spent 30 years in making another. The Writing Androides is merely a pentograph, worked by a confederate out of sight. So also the Automaton Chess-player, and the Invisible Girl; but they are in general constructed of wheel-work. Vaucanson, in this way, made a Flute-player; Kempelen, the Chess-player and Speaking Figure. M. Mallardet and Mr. Hancock made many; and, while they display great contrivance, they draw large sums from the credulous.

Vaucanson made an artificial duck, which performed every function of a real one, even an imperfect digestion, eating, drinking, and quacking. A coach and two horses, with a coachman, footman, page, and a lady inside, were made by Camus, for Louis XIV., when a child. The horses and figures moved naturally, variously, and perfectly.

Cotton-spinning machinery, and manufacturing machinery in general, are merely varieties of these inventions of Androides and toy-makers; a central power, with axles, wheels, cogs, ketches, ratchets, straps, lines, levers, serews, &c. &c. variously combined, constitute the wonders of Lancashire, Yorkshire, and Warwickshire.

LITERATURE AND EDUCATION.

Perception, memory, and reasoning by analogy are faculties common to all animals; and, according to their perfection, they create degrees of natural knowledge in the several genera. species, and individuals. But natural knowledge is personal and evanescent, without Records; while, by their means, the knowledge of one generation is added to another, and accumulates by a law of acceleration. The invention of conventional signs, characters, or letters, was therefore the first step to that accumulated knowledge which we now find in the world. The first examples were records of regal vanity; then their celebration in verse. The next, the regulation of reasoning in logick. The next, the observed motions of the heavenly bodies. The next, arithmetick and geometry. The next, geography, chronology, and history. The next, observations of nature, and the investigations of causes. But the free play of intellect proving injurious to monopolies of power, and the selfish advantages of superstition which had obtained ascendancy before the invention of letters, these have always been opposed to the advance of knowledge, and have either limited or neutralized inquiry. The age has therefore not yet arrived, when the pursuit of knowledge is perfectly free; and advancement has hitherto been determined by limits authorized by power, or by prejudices inculcated by power, and operating directly or insidiously, so as to say to all pursuers of knowledge, —thus far mayest thou go, but no further.

Troth, the Egyptian, who invented writing, perhaps hieroglyphicks, lived between the years 2000 and 2500 B. C. But Josephus says, he had seen inscriptions by Seth, the son of Adam. If so, then Troth, or Hermes, were not the inventors of writing, or Josephus must on this, as on many subjects, be fabulous.

The first letter of the Phœnician and Hebrew alphabet was *Aleph*, which the Greeks called *Alpha;* and the moderns, by abbreviation, A. They also used them to count; and, it is curious that *tau*, used by them for 100, is, in the games of English school-boys, the name of a white marble, worth many common ones. The word Alphabet is the names Alpha, Beta, just as we say the A, B, C. The Hebrew language and letters are believed to be derived from the Phœnician, since Tyre, Sidon, &c. were distinguished cities in the age of Moses and Joshua; even Abraham lived in their territory.

Sanscrit is the basis of Hindoo learning, and said to be the first character. It is taught at Benares by pundits, or doctors; and the pupils read the Puranas, or abridgements of the law, and study philosophy, like that of the Greek schools.

The Hindoos have no less than nine sects of philosophers, whose principles embrace all the metaphysicks and speculations of the Greeks, and the objects of controversy among modern Europeans. Three of them are atheistical, and six are partly materialists and partly spiritualists in certain shades of difference. No justice is done to their profundity in the crude or partizan reports of Europeans.

The Welsh language, always regular and significant in its monosyllables, uses the word *pen*, to signify the top; *mawr*, great; *tre*, for a house; *aber*, for the confluence of rivers; *Aron* for a river; *care*, for a fortification; *Llan*, an enclosure; *ys*, pronounced *us*, for lower; and *uwch*, for upper; *coed*, for a wood; *cum*, pronounced *coom*, signifies a deep valley; and *yr*, pronounced *ur*, is the article—the; and its constant repetition leads to the vulgar jokes about the *yr* or *ur*. Their nouns have no cases.

The Welsh, or Bardick alphabet, consisted of 16 primitive or radical characters, and 24 secondary ones, formed by cutting letters on a stick in a triangular or square form.

The most ancient Arabick, called the Kufick, is so named from Kufa, on the Euphrates, and not now in use. The modern Arabick was invented by the Vizier Molach, A. D. 933, in which he wrote the Koran three times.

Armenian is used in Armenia, Asia Minor, Syria, Tartary, &c. It approaches the Chaldee or Syriack, and the Greek.

Chaldee, Phœnician, or Syriack, ascribed to Adam, Enoch, Noah, Abraham, and Moses, is the same as the Hebrew.

The Coptick is an alphabet so called from Coptos, in Egypt, a mixture of Greek and Egyptian. The characters of the ancient Egyptians were of three kinds, vulgar, sacred, and hieroglyphick.

Ethiopick, or Abyssinian, is derived from the Samaritan or Phœnician.

The Etruscan was the first alphabet used in Italy, so called from the Etrusci, the most ancient inhabitants.

Gothick, the most ancient characters under this name, are attributed to Bishop Ulphilas.

Cadmus, the Phœnician, introduced the first Greek alphabet into Bœotia, where he settled, B. C. 1500; though Diodorus says the Pelasgian letters were prior to the Cadmean. But it is evident that the Cadmean and Pelasgiack, and Phœnician, had the same origin.

The Samaritan, or Phœnician, was the original Hebrew character; and the present alphabet was invented after the captivity.

The Irish alphabet is the Phœnician.

The Greeks called the Phœnicians *Pelasgii quasi Pelagi*, because they traversed the ocean, and carried on commerce with other nations.

Scaliger supposes the Phœnician to have been the original Hebrew character, otherwise the Samaritan, which is generally supposed to be that which was used by the Jews from the time of Moses to the Captivity.

The alphabet of the Sanskrita, is called the Devanagari.

The Oriental Alphabets are Hebrew, ancient, modern, and rabbinical. Samaritan, ancient and modern. Phœnician. Syriack, ancient and modern. Egyptian, hieroglyphick. Chinese, characters.

The Greek Alphabets were Cadmean, Pelasgian, Sigean, Nemean, Delian, Athenian, and Teian. Also Ionick, or alphabet of Simonides.

The alphabets derived from, or allied to, the Oriental Alphabets are, Cufick, Arabick, Persian, Saracen, Ethiopick, Mendean, Malabarick, Mantchou Tartar, Sanscrit, Japonese, Thibetan, Rejang.

The Alphabets derived from the Oriental or Greek Alphabets are, Ancient Irish, Bobeloth and Bethluisnon. Ogums, namely, Croabh and O'Sullivan's Coptick, Armenian, Georgian, Dalmatian, and Russian.

The Northern Alphabets are, Gothick, ancient, modern, and Mæso-Gothick, Runick. Welsh. Saxon, ancient and modern. Teutonick. German, printing and current. Flemish. French, ancient and current. Norman and Anglo-Norman. Bastard, ancient and round. Lombard. Charlemagne. Black Letter. Chancery, round and running. Court Text. Church Text.

The Alphabets of different nations contain the following letters:—

English	26	Greek	24
French	23	Hebrew, &c.	22
Italian	20	Arabick	28
Spanish	27	Persian	32
German	26	Turkish	33
Sclavonick	27	Sanscrit	50
Russian	41	Chinese	214
Latin	22		

In the west, letters were invented by Thaut, a Phœnician, son of Misraim, and also called Hermes and Mercury. But, it is believed, that he only modified the older Sanscrit Alphabet, which was brought from the east by the commercial Phœnicians. The Sanscrit contains 16 vowels and 34 consonants, and is the parent of most of the Oriental alphabets, even of the Greek.

T. Sheridan reckoned 28 simple sounds, and proposed a new alphabet of 9 vowels and 19 consonants.

An alphabet of 13 letters has been proposed,—the five vowels and the consonants b, g, d, l, m, n, r, s.

During six or seven centuries the Latin tongue prevailed in all publick proceedings, from the Tweed to the Euphrates, and from the Danube to Mount Atlas; and the language of the rapacious Roman conquerors has been more or less retained by servile classes even to this day.

Adelung, the celebrated German philologer, was born in 1734, and died at Dresden in 1806. His German Dictionary is the standard of the language. In his general history of languages, he gave specimens of the Lords Prayer in 500 languages and dialects.

The oldest authentick date in numeral characters is 1375, written on the leaf of a book by Petrarch; and they appear to have travelled into Europe, through Arabia, from India; but when invented is not known. The oldest treatise on this arithmetick in Sanscrit, is called *Lilawati*, and written about 1185. At first, in Europe, it was written in the Arabian manner, from left to right, beginning with 0 and ending with 1.

Smart calculated 20,410 noun substantives in Johnson's Dictionary, 9053 adjectives, 7880 verbs, and 2592 adverbs. Todd and Taylor have increased these full half, making about 60,000 words in the English language.

Horne Tooke, in his fanciful theory, endeavours to make it appear, that *if* is derived from the Saxon *giffan*, to give; *but* from *botan*, to boot; *yet* from *getan*, to get; *though* from *thaffigan*, to allow; *unless* from *oulessan*, to dismiss.

There are two languages spoken in Germany, one called Low Dutch and the other High German. The former prevails in Westphalia, Prussia, Lower Saxony, and on the coast; the other is spoken on the Rhine and Danube.

A Cherokee, named *Sus-gue-jah*, about 1820, invented an alphabet of the Cherokee language; and also Digits for numbers, to effect the purposes of "the speaking leaf," but without any knowledge of other characters or digits.

The English, in pronunciation, dwell on, or accent consonants; the Scotch on vowels; and the Irish have a rising and falling inflexion, or accent.

The nine Muses are—Clio, or Glory·

Euterpe, pleasure; Thalia, flourishing; Melpomene, attracting; Terpsichore, rejoicing; Erato, gentle; Polyhymnia, variety; Urania, celestial; and Calliope, sweetness. These ideas serve painters, and help the measure of lame poets.

Anciently odes were divided into Strophe, Antistrophe, and Epode. The Epopœia is the subject.

The figures of Rhetorick are similes, metaphors, allegories, and personifications. Some forms of expression are also called figures, as irony, antithesis, climax, apostrophe, hyperpole, &c.

Heroick measure, in English poetry, is ten syllables. Iambick verse, is when unaccented syllables alternate with accented. In Anapestick verse, the accent falls on every third syllable.

A dactyl is one long and two short syllables; a trochee, is one long and one short; a spondee is two long syllables; and iambicks are like trochees. There are 28 feet, or metres, consisting of two, or three, or four short and long syllables. Hexameter verse is of six feet, the first four, dactyls or spondees, the fifth a dactyl, and the sixth must be a spondee. Pentameter is five feet. The two first dactyls, or spondees; the third a spondee; and the two last anapesta, or two short and one long syllable.

A syllogism is a process of reasoning from a general or *major* proposition by a *minor* one, and affirming or negativing the assertion in the *major* as to the *minor*, in a *conclusion* or inference. Equivoques in the use of words, in the major or minor, lead to sophistical conclusions, and to the endless confusions of opinions.

Syllogisms have four figures—1. When the middle term is the subject of the major proposition, and the predicate of the minor. 2. When the middle term is the predicate of major and minor. 3. When the middle term is the subject of both. 4. When the middle term is the predicate of the major, and subject of the minor. Each figure, also, has its moods. Syllogisms are also conditional, disjunctive, &c. &c.

Every proposition consists of a subject and predicate, and of a connecting word called the copula, either affirmative or negative.

The predicate is that which is affirmed or denied in any proposition.

The classes of Sophisms or false reasoning are—

1. *Ignorantio Elenchi*, or a mistake of the question.

2. The *Petitio Principii*, taking for granted what is to be proved, or *arguing in a circle.*

3. The *non causa pro causa*, making that a cause which does not exist at all, or in the case in question.

4. The *fallacia accidentis*, drawing general conclusions from accidental circumstances.

5. A *dicto secundum quid, ad dictum simplicitur*, a general deduction from particular circumstances; or a general truth applied to all circumstances. Another sophism arises from the ambiguity, or double sense of words.

A *genus* is a general resemblance, as, that of the horse, ass, mule, zebra, is one genus; so oxen, buffaloes, bisons, &c. are another genus; and, of these, the horse, the mule, ox, &c. are species.

Every oration, or argumentative discourse, consists really or covertly of an *exordium*, *question*, *narration*, *argument*, *refutation*, *conclusion*, and *peroration.*

Bards, among the Druids, were professional poets; and, among all ancient people, such employments were recognised, and connected with religion, prophecy, and musick. Among the Jews this class were called Prophets, and their compositions called *Prophecyings*. The Greeks called them Ubates; the Romans, Vates; and the Britons, Bards. Ossian speaks of a prince who kept 100 bards. Chief-bards wore sky-blue garments; and, the most distinguished, a silver chain. Even Alexander the Great was accompanied by a bard named Cherylus, who was to have a piece of gold for every good verse, and a blow for every bad one.

The first Greek writers were Homer and Hesiod, 1000 B. C.; and Tyrtæus and Archilochus, in 700; and Alcæus, Sappho, and Anacreon, in 600. The first Latin writers were

Plautus, Ennius, and Terentius, in 200 B. C. The first British, Gildas, Nennius, and Bede, in 500 and 600. The first German, Eginhard, Wallafrid and Rabanus, in 800. The first French, Fort, Gregory, and Maralfe, in 500. The first Spanish, Anian, Fulgentius, and Martin, in 500. The first Polish, Yaraslof and Nestor, in 1000. The first Italian, Gratian, Falcand, and Campanus, in 1100.

The Poems of Homer were chiefly traditional and oral, till Pisistratus collected them in writing 4 or 500 years after the age of the poet, just as Ossian was collected by Macpherson. In the east, it is believed that there are not a dozen copies of the Shastah, Vedah, and Zenda Vesta. In 1400, there was scarcely a book in Rome but missals.

The works of Homer are supposed to have done great injury to mankind, by inspiring the love of military glory. Alexander, was said to sleep with them always on his pillow.—*Darwin.*

The printing-press has been unfavourable to the perfection of modern books. An author prints a large edition, and often has no opportunity of correcting; but every copy was an edition to an ancient author, and he had as many opportunities of revising as there were copies made. This explains the precision of the classick authors, which would be increased by the taste of learned copyists in after ages.

The utility of printing, as far as regards the progress of truth, is counteracted by the great expense of setting the types; for, as all books sell best which flatter prevailing opinions and support vested interests, and as they are printed chiefly at the risk of traders, who print for sale and profit, so few (very few) printed books contain the whole truth, and nothing but the truth.

Before the art of printing, books were of incredible price. From the 6th to the 13th century many bishops could not read, and kings were scarcely able to sign their names; and hence the use of seals and sealing. These were the ages in which superstition, witchcraft, and priestcraft obtained so universal an ascendency. From 500 to 1200 all learning was in the hands of the Arabs Saracens, and Chinese. Copying was, in ancient Greece and Rome, a productive employment; but it afterwards fell into the hands of the monks, who copied chiefly theology. A good copy of the Bible, on vellum, employed two years; and the works of either of the Fathers still more time. Jerome states, that he had ruined himself in buying a copy of the Works of Origen. Of course, copiers altered and vitiated, corrected the language, interpolated, &c. according to their honesty, taste, faith, or party; and hence the endless controversies among criticks and theologians about words, phrases, and paragraphs. It thus appeared, that, at the Council of Nice, in 325, there were 200 varied versions of the adopted Evangelists, and 54 several Gospels preserved in various Christian communities, but so scarce that no Roman historian or writer appears ever to have seen them.

Books were originally boards, or the inner bark of trees, the word being derived from *Bench*, a Beech-Tree. The Horn-Book, now used in nurseries, is a primitive book. Bark is still used by some nations; skins are also used, for which parchment was substituted. Papyrus, an Egyptian plant, was adopted in that country, and an article of commerce; thin plates of brass were also used for church service. The papyrus and parchment books were commonly rolled on a round stick, with a ball at each end, and the composition began at the centre, the outer fold being its termination; these were called volumes. The outsides were inscribed just as we now letter books. The MSS. in Herculaneum, consist of papyrus, rolled and charred, and matted together by the fire, and are about nine inches long, and one, two, or three inches in diameter, each being a volume or separate treatise. Of course, as books were scarce, and the art of reading uncommon, they were very dear. The bequest of one to a religious house entitled the donor to masses for his soul, and they were commonly chained to their station; while, in some ancient libraries, the books are chained to this day. As specimens of the prices of books, the *Roman de la Rose* was sold for above 30*l.*; and a Homily was exchanged for 200 sheep and five quar-

ters of wheat; and they usually fetched double or treble their weight in gold. When the passion for reading increased, the business of copying became considerable, and copyists enjoyed great reputation, according to their learning and accuracy. Hence they took it on themselves to purge and improve authors; and to this cause may be ascribed the precision and mechanical perfection of the classick authors, for the copyists plumed themselves on not transcribing imperfections. This advantage was, however, counteracted by the principles which governed them; and hence the first printers were also criticks, like the copyists.

The modern names of sizes of books are derived from the folding of paper; when the sheet is not folded it is called a folio, and this size was very fashionable through the 16th and 17th centuries. The folio sheet doubled, becomes a quarto, and this has been thought the most convenient form; another double constitutes the octavo, of eight leaves, or 16 pages; another double, the square 16mo. The sheet folded into twelve leaves, is called a duodecimo; into 18, an octodecimo, or 18mo.; and then doubled again, becomes a 24mo. or 36mo.

The first printed books were trifling Hymns and Psalters, with images of saints, and, being printed only on one side, the leaves were pasted back to back. One of the first was the Biblia Pauperum, of 40 leaves, which, pasted together, made 20. An entire Psalter was printed, in 1457, by Faust and Schoiffer; and a Bible, in 637 leaves, in moveable types, was printed at Mentz, between 1450 and 1455; but the most important part of the invention (that of the moveable types) is uncertain, both as to name and date. The first characters were Gothick; and Roman type was first used in 1467.

Some writers give the invention of printing to Guttenberg, of Mayence; while others ascribe it to Faust, (often called Dr. Faustus), of the same city; and others to Lawrence Koster, of Haerlem. The copyists made so great a clamour, that the parliament of Paris at first, to oblige them, caused all printed books to be seized.

Printing by blocks was an extension of the art of seal engraving which had been carried to great perfection in broad seals. The first printed sheets were worked only on one side of the paper, and the impressions produced by a plane and mallet. The ordinary printing-press was first made by Bleau, at Amsterdam; the first types were cast in England, by Caslon, in 1720. The printing-machine was first suggested by Nicholson, in 1790; and stereotype printing was used in Holland during the last century. The rollers for inking the types were the suggestion also of Nicholson. Stereotype printing was introduced into London, by Wilson, in 1804. The last adopted improvements have been the Stanhope press, and the Columbian press.

Caxton was the first English printer, and his printing-office was in the Chapter-house of Westminster Abbey. He learnt the art in Germany, and was liberally patronized in England. The first book printed by Caxton was in 1471, and bore for its title, "*Willyam Caxton's Recuyel of the Historyes of Troy, by Raoul le Feure.*" While the Bibliomania prevailed, a copy was knocked down, at auction, for 1060*l.* 18*s.*

Foreign printers call types by different names from those in England, thus our Pica is their Cicero.

A sheet of type is about 120 lbs., or 60 lbs. to a form. The proportions in founts, as of 100,000 letters in English, would be 5000 a; 3000 c; 11,000 e; 6000 i; 2000 m; and of k, q, x, and z, not above 30.

Antimony is a metal with a specifick gravity of 6.702, which alloyed with lead, makes types.

England is the only country in which books are advertised, and this expense adds 30 per cent. to their price. In France, two copies are sent to about 20 journals, and their notice is the sole advertisement, besides the publick voice. In England the publick voice is surrendered to advertisements and puffs in every form, aided by mock criticisms.

Trade in books has multiplied them in modern times. There are now printed, annually, about 1000 books and pamphlets in the United Kingdom, besides 120 periodicals

twelve times a year; 20 others, 52 times; 12 quarterly, and 300 several newspapers. In France, the new books and pamphlets are about 1500 per annum.

Books and paper were formerly sold only at stalls, and the dealers therefore were called *Stationers*.

The largest impressions of any single book were those of Moore's Almanack, a proof of the prevalence of superstition. For many years, during the late wars, when political excitement was excessive, the Stationers' Company sold from 420 to 480 thousand copies per annum of Moore's Astrological Prophesying Almanack. About 50 years since, the Company resolved no longer to administer to this gross credulity, and, for two or three years, omitted the predictions, when the sale fell off one half; while a prognosticator, one Wright, of Eaton, near Woolstrope, published another, and sold 50 or 60,000. To save their property, the Company engaged one Andrews, of Royston, also a native of Woolstrope, to predict for them, and their sale rose again as above. The Company have three or four prophesying almanacks, and three or four of rational and scientifick character; but the sale of the former is, to that of the latter, as twenty to one.

The editions of books run by two hundred and fifties, every 250 being the mode of charge by printers. Few books pay for setting the types at less than 500, which, therefore, is the common edition of ordinary books. Others run 750, 1000, or 1500. School-books and others, in small type, demand 2 or 3000. And, of many modern school-books, under the names of Blair, Goldsmith, Barrow, &c. 10 or 15,000 have been printed per annum for a series of years. Of Paine's Rights of Man, 150,000 were sold within twelve months; and 30,000 of Burke's Reply. In France, editions are larger than in England, owing to the demand in foreign countries. Three-fourths of the books printed do not pay their expenses; and not above one in ten realizes a profit.

There are about 4500 booksellers, and venders of books, in the United Kingdom.

The fame of most writers is very ephemeral, chiefly owing to their choice of subjects of the day, or the age or nation. English literature does not preserve above eight or ten authors before the age of Shakspeare; not above 20 from Shakspeare to Addison, and scarcely 50 from the age of Addison to the year 1800. Since the days of Elizabeth one or two books, or pamphlets, per day have been printed; but the subjects were obsolete theology, forgotten politicks, or superseded philosophy, and the majority in bad method or bad taste. It has been the same in France, Germany, Italy, and Holland; and doubtless, was the same among the ancients, though we so often lament the loss of ancient works.

The decline of literature, in England has been accelerated, or caused by a passion for novel reading, which deprives all other studies of their reward. It resembles the Roman literature in the decline of the empire; and, for some years past, few books but novels have paid their expenses. A good novel yields its author 1000*l.* or 1500*l.*; and Dr. Johnson's high price for his Dictionary, was but 1575*l.* A novel, written in two months, will yield its author 400*l.* or 500*l.* as a current speculation; and England has, therefore, become a nation of superficial novel writers and readers.

The *Constitutionel* French paper sells between 14 and 15,000 per day. The *Gazette de France* above 9000; and the *Journal des Debats* nearly 9000. The other papers, in October, 1830, were below 5000; and the *Moniteur* not 1500. Owing to the stamp, and the consequent high price, no daily London paper sells above 9000; and the chief part not above 1500. Some of the Sunday papers sell from 10 to 15,000.

Stamps used for London papers in 1829.

Times and Mail . .	3,275,311
Herald & English Chron.	2,000,475
Chroniele, and four others	2,333,450
Morning Post . .	598,500
Courier . . .	995,200
Globe	864,000
Sun	625,000
Star	593,000
John Bull . . .	337,500

Bell's Messenger	566,000
Ditto Despatch	780,552
Literary Gazette only	70,430
Cobbett	176,500
Atlas	246,200
Age	256,000
Sunday Times, &c.	407,003
News	253,000

In 1831, the Herald, Star, Age, and Atlas have considerably increased in sale, and may now be taken at 25 or 30 per cent. higher. The Literary Gazette, by these returns, has the lowest sale of the whole, and appears to be eleven times less than the Despatch.

The Age and Numbers of the Newspapers of London, on February 1, 1831:

Morning Herald	65 years	20,702
Morning Chronicle	61 ditto	19,167
Times	46 ditto	14,501
Star	43½ do.	13,697
Morning Advertiser	39½ do.	12,409
Courier	39 ditto	12,326
Sun	38 ditto	11,978
Globe	28 ditto	8,821
British Traveller	19 ditto	5,974

The Dublin papers consumed, in 1830, 2,262,513 stamps. The highest, daily, were the Evening Mail, 439,000; Saunders' News Letter, 434,500; The Evening Post, (three per week), 293,350; the Evening Packet, 198,172; the Morning Register, daily, 196,300; the Weekly Register, 154,860.

The newspapers in the United Kingdom are about 340 per week, and their average sale 120,000 per day, consuming 87,600 reams; and the 150 periodicals consume about 30,000 reams. The stamp-duty on these papers, in 1829 was 509,546*l.*; and the duty on the paper only was above 30,000*l.* In France, in 1828, the sale was 144,000,000 or 288,000 reams. The reams of paper, stamped for the periodical press, in 1820, was 50,717 reams. North America, in the year 1720, possessed no more than seven newspapers; but, in 1820, the United States had 359; and, 10 years subsequently, the number had increased to 740.

Regiomontanus made the first Almanack in 1474.

The English Periodicals have a large circulation, nearly as under, in 1831:

Evangelical	9000
Armenian	13000
Blackwood's	5000
Frazer's	3000
New Monthly	2000
Monthly	750
Gentleman's	2000
Ladies'	1800
Englishman's	1500
Metropolitan	1800
Quarterly Review	8000
Edinburgh	3500
Westminster	2500
Loudon's	2100
Medical	500
Philosophical	500
Monthly Review	500
Brande's Journal	600
Brewster's Journal	750
La Belle Assemblée	1000
Christian Observer	4000

There were, in 1830, printed in London, daily or weekly, 54 distinct newspapers; and, in England and Wales 154 others. The whole number of papers which they sell in a year, is 25 millions. The 208 in England, and 36 in Scotland, make 346 publications per week; and, in a year, 17,200 several separate publications, which gives an average of 1400; but about one-tenth publish treble this number; one-tenth, double this number; two-tenths, a fifth this number; another two-tenths, about 1000; so the other four-tenths sell from 750 to 500, or average 625. Clement, proprietor of the Morning Chronicle, Englishman, Observer, and Life in London, sold 2¾ millions of those papers only per annum, and paid, in stamps and duties, not less than 1000*l.* per week.

In 1829, the clerks of the roads transmitted, from London, 1,207,794 newspapers; and 316 daily papers abroad; while the various venders transmitted 10,654,912.

The 25 millions of newspapers, sold annually in England, consume 100,000 reams of paper; and these 346 several publications give constant employment to ten persons on each, as editors, printers, publishers, &c. &c. In London, about two-thirds of the matter in each is printed from MS.; in the country, about

two thirds is transferred from the London and other papers.

The *United Kingdom*, one of the largest of our Sunday papers, so called, is worthy of its object in its own unequalled dimensions. Every page contains seven columns, and is 24½ inches long by 19½ wide, containing 480 square inches per page. The four pages contain therefore, 1,920 square inches, and every square inch, on the average, 32 words! Hence this surprising sheet contains above 60,000 words, sold for 7*d.*, or 2150 words for every farthing.

The word *Gazette* is derived from the name of the Venetian coin, which was the price of the first newspaper.

The London Gazette was commenced, at Oxford, on November 7, 1665; the Court then residing there, on account of the plague.

The first regular critical journal was the Journal de Sçavans, began in 1665, and continued for nearly a century. The first, in England, was called the Waies of Literature, which commenced in 1714, and was discontinued in 1722; and the present state of the Republick of Letters began in 1719.

Various Periodical Miscellanies were commenced in the reign of Queen Anne, and continued for various periods. Cave took up an old title in the Gentleman's Magazine, in 1731; and, in 1732, the London Magazine was begun.

The total number of new publications, in the year 1812, in London, was 693; and their cost, in boards, 230*l.* They have since increased to 800, at a cost of 400*l.*, for one copy of each.

Reviews of Books, under the false pretence and colour of criticism, are usually written by the friends or enemies of authors, or of the publishers of the works, and are trading frauds, which now delude only the ignorant. No such opinions can have any authority without the known name of a responsible critick. Nevertheless a malignant spirit in readers who often delight in slander, occasions the most vituperate anonymous criticisms to be most read and patronised.

The following French Periodical Publications were sent daily by the post, in February, 1831.

DAILY.	*Subs.*
Moniteur	2224
Constitutionnel	15400
Debats	8882
Gazette de France	10019
Courier Français	3930
Le Temps	6596
Quotidienne	4810
Le National	2919
Le Messager	1328
Galignani's Messenger	1308
Commeree	1303
Gazette des Tribunaux	1279
L'Avenir	1688
Le Globe	1270
L'Eeh Français	1154
Figaro	668
La Tribune	564
La Révolution	552
Journal de Paris	223
Courier de l'Europe	750
PERIODICAL.	
Courier des Electeurs	2520
Journal de l'Enregistrement	1060
Journal des Maires	6374
Le Cabinet de Lecture	402
Journal des Dames	1076
Petit-Courier des Dames	1771
Le Voleur	1111
Le Correspondant	1300
L'Echo des Halles	1030
Gazette des Tribunaux	301
L'Ami de la Religion	780
La Feuille Française	340
La Caricature	235
Gazette Médicale	422
Journal de la Librairie	265
Journal des Salons	280
La Mode	586
Revue de Paris	360
Revue Britannique	752
Idem Encyclopédique	287
Idem Médicale	287
L'Ami de la Jeunesse	360
Archives du Christianisme	420
Idem de la Médecine	410
Société d' Encouragement	220

The numbers circulated in Paris *about a third more.*

There are, by other accounts, in Paris, 152 journals, literary and religious; and 17 political. One hundred and fifty-one are liberal, having 197,000 subscribers; and, the other 18 have 21,000. There are 75 provincial journals, with 99,000 sub-

scribers. In all, 244; with 317,000 subscribers.

In 1829, the British and Foreign Bible Society had circulated, in 25 years, 11 millions of copies of the Jewish Scriptures, in 150 languages; and, in 1828, 365,424. Hence, as each book contains 30 sheets, this would make 330 millions; and they have therefore expended 660,000 reams of demy paper, duty free, at 20*s.*; and also as much more in printing and editing, or above a million sterling, in paper and printing, besides 1*s.* 6*d.* for binding, making another 825,000*l.*

The issue by the London Society, during the year 1830, had been 325,453 Bibles and Testaments at home, and 108,829 on the continent; making, altogether, a total of 434,422 copies. The income had been 84,982*l.* 5*s.* 11*d.*; and the expenditure amounted to 81,610*l.* 13*s.* 6*d.*

The early Chinese literature suffered a similar misfortune to that of the west in the destruction of the Alexandrian Library; for their Emperour, Chee-whang-tee, ordered all writings to be destroyed, that every thing might begin anew as from his reign; and their books and records were afterwards recovered by succeeding emperours with great difficulty. So the Musselmen conquerors of Hindostan destroyed the chief part of the most ancient writings.

In Thibet, there is a Cyclopedia, in 44 volumes; and lithography has been practised there from time immemorial.

At Stevens's sale, the first edition of the Merry Wives of Windsor sold for 28*l.*

The Bible, used by Charles I., at his execution, is preserved in the Royal Library, at Berlin.

It has been stated, that the six largest libraries in Europe contain the following number of volumes and MSS.:—

	Volumes.	*MSS.*
Royal Library of Paris	450,000	77,000
Bodleian, Oxford	420,000	30,000
Munich University	400,000	9,000
Vatican, at Rome	100,000	40,000
Gottingen University	300,000	5,000
British Museum	500,000	120,000

Besides the Museum, there are the undermentioned in England:—Cambridge University; Advocates', Edinburgh; Sion College; and Dublin University; and, in London, the Library of the Royal Institution, the London Institution, and five or six others.

The Advocates' Library, at Edinburgh, contains 100,000 volumes, besides ancient MSS., and a cabinet of scarce and valuable medals.

Italy had, in the 15th century, so many associations, like our societies, called Academies, that there were 550 for general or particular pursuits. The French imitated the Italians in the 16th and 17th centuries; and, in the 17th and 18th, the English imitated both, in the Royal and other Societies; and of late they have been so extended, as, perhaps, to equal the Italian societies in number. They spread knowledge, but subdue original thinking by the deference to existing authorities. In Italy, therefore, no new discoveries are traceable to them; and, in England, the distinction in numerous ones consists in merely knowing the current knowledge repeated in books.

Academia della Crusca, was founded in	1582
——— del Cimento	1610
——— Bononiensis	1690
L'Academie Françoise	1635
——— de Peinture et de Sculpture	1648
——— des Inscriptions et Medailles	1663
——— R. des Sciences (Institute)	1666
R. Academy of Sciences at Berlin	1700
Royal Society of London	1665
R. Spanish Academy	1714
R. Academy of Sciences at Lisbon	1779
Petersburgh	1725
Stockholm	1741
Copenhagen	1742
The American Academy, Boston	1779
The Royal Irish Academy	1782
The Academy of Ancient Musick	1710
The Royal Academy of Arts	1768
Royal Military Academy, Woolwich	1741

The French Academy was created by Louis XIII., in 1635. Its original pursuits were Eloquence and Poetry. In 1648, it was extended to the Fine Arts; and, in 1666, by Colbert, to the Arts and Sciences.

The following is a list of the principal Literary Societies in the United Kingdom, with the fee on admission, and the initial letters distinguishing the members :—

Royal Society, 50*l.*, F.R.S.
Royal Society of Edinburgh, 25*l.* 4*s.*, F.R.S.E.
Royal Academy of Dublin, 26*l.* 5*s.*, M.R.I.A.
Royal Society, Literary, 36*l.* 15*s.*, F.R.L.
Antiquarian Soc., 50*l.* 8*s.*, F.A.S.
Linnæan Society, 36*l.*, F.L.S.
Geological Soc., 34*l.* 13*s.*, F.G.S.
Astronomical Soc., 25*l.* 4*s.*, M.A.S.
Zoological Society, 26*l.* 5*s.*, F.Z.S.
Royal Institution, 50*l.*, M.R.S.
Royal Asiatick Society, 31*l.* 10*s.*, F.R.A.S.
Horticultural Soc., 48*l.* 6*s.*, F.H.S.
Medico Botanical, 21*l.*, F.M.B.S.

In 1827, only 109 of the 1150 F.R.S. had contributed to the Transactions: and, of these, 11 only had titles.

The Royal Society of London is governed by a president and 18 council, with about 1000 members. The Royal Society of Edinburgh has a president, five vice presidents, and literary and physical councils.

The Antiquarian Society was established in 1751; and there is another in Scotland, 1780.

The Royal College of Physicians, founded in 1523, has a president, 96 fellows, about 18 candidates, and about 320 licentiates. The Royal College, at Dublin, 33 fellows, and 60 licentiates. That of Edinburgh (1681), about 100 fellows, of whom a third are resident.

The College of Surgeons is governed by a president, 20 vice-presidents, 7 curators, and 4 professors, with officers.

The British Museum is governed by 23 official trustees, 9 of the families of donors, and 14 elected. There is a principal librarian, and 14 keepers and assistants. The number of visiters per annum is about 50,000.

The Literary Fund was established in 1790, for the eleemosynary relief of destitute authors.

The Asiatick Royal Society was incorporated in 1824, for literary and scientifick purposes.

The Institution for Improving and Exploring Africa was formed in 1807; and there is also an African and Asiatick Society, with religious objects.

There is an Anti-Slavery Society, of which the Duke of Gloucester is Patron.

The Horticultural Society of London was founded in 1808, and has been eminently useful in naturalizing foreign plants and improving gardening. There is another at Edinburgh, and others in nearly every county.

The total number of visiters to the Horticultural Gardens, in 1830, was 224,745. But this is exceeded by the visiters to the Zoological Gardens, in the Regent's-park, often 1500 per day.

The Garden of Fromont, six leagues from Paris, contains 130 acres, and more than 6000 species and varieties of vegetables, many of them still new in France. Some of the green-houses are 2,000 feet in length, with glazed roofs, possessing all varieties of exposure.

The Athenæum, in Waterloo-place, is a club of distinguished amateurs of literature.

The term *Blue Stocking*, applied to literary ladies, was conferred on a society which was called the Blue Stocking Club, in which females were admitted; and so called owing to a Mr. Benjamin Stillingfleet, one of its acting members, always wearing blue stockings.

In general, literary and philosophical societies are close corporations, very unfavourable to originality and the advance of knowledge beyond a prescribed beaten track. They are usually governed by ancient authorities, and by the prejudices of the education of the senior or leading members; and, hence, having a certain weight with the vulgar, they impede the march of discovery. They help to spread what was known when they were founded; but they look with stern jealousy on all innovations, and guard, with vigilance,

the orthodox faith recognised, continued, and cherished by their society. Thus they give countenance to errour, and serve as engines to keep knowledge within the limits prescribed by civil and ecclesiastical power.

Incomes of several Religious Societies of England:—

British and Foreign Bible Society,	84,982*l.*
Christian Knowledge Society,	65,929
Gospel Propagation Society,	34,693
Church Missionary Society,	47,328
London Missionary Society,	48,226
Wesleyan Missionary Society,	46,302
Baptist Missionary Society,	17,185
London Jews' Conversion Society,	12,145
Hibernian (London) Society,	9,228
National School Society,	2,183
Religious Tract Society,	24,973
Slave Conversion Society,	4,375
Naval and Military Bible Society,	3,396
	400,950*l.*

There are three methods of acquiring knowledge—first, by committing to memory in the manner of tasks, which usually are forgotten as soon as said by rote; second, reading books, which makes but a fleeting impression, and leaves only general ideas; and, third, answering, by original exercise, questions upon books, and on the facts and principles contained in them, by which the student is compelled to think for himself, and to evince his acquaintance with the subject. This is called the Interrogative system, and it has been applied to every subject of study with unequivocal success. The interrogative system, by questions, *without* answers, is however to be carefully distinguished from the vulgar method of writing books in questions *with* answers, by which no advantage is gained.

The system of infant schools embraces children just emerged from the nursery, and instruction is effected by toys and sensible objects, and by the patience and address of the tutoress.

The system of Pestalozzi consists of oral questions, proceeding synthetically from simple to complicated objects, and the answers are given orally. It is similar to the interrogative system, but does not possess the practical convenience and intellectual advantages which attend the writing of the answers, which act is a simultaneous exercise in spelling, grammar, and composition.

The Hamiltonian system, for teaching language, is similar to that developed in the little books bearing the name of the Abbé Bossut; both consider the words of a language as the primary objects to be learnt, and then the phrases or idiomatick construction.

The system of Bell and Lancaster is an appeal to the eye and memory, in small classes directed by monitors, who are the more forward children, and who perfect themselves while teaching the others, so that one master may thus superintend the economy and exercises of several hundred pupils; and it is therefore a cheap method of teaching the mass of the juvenile population the first elements of knowledge.

The interrogative system of instruction, invented and introduced by the editor of this work between 1798 and 1827, consists of text-books and questions on the text-books, *without answers*, which are to be furnished in writing by the pupils; and keys are printed to the questions for the ease of tutors.

The system of teaching languages by words, phrases, and grammar in consecutive succession, as in the nursery, was first published, in 1803, in elementary works, under the assumed name of the Abbé Bossut. In 1815, it was announced as a discovery by Hamilton.

The University of Oxford is governed by a chancellor, high-steward, vice-chancellor, and 4 pro-vice-chancellors. There are 19 colleges and 5 halls, the oldest University having been founded in 1172; and, the last, Worcester, in 1714. The professors are 27; of whom there are 2 in divinity, 2 in Arabick, and 1 in the equivocal science of political economy.

Cambridge University consists of a chancellor, high-steward, and deputy vice-chancellor, a commissary, publick orator, librarian, 3 esquire bedels, 24 professors, 3 preachers and cura-

tors of the Botanick Garden and Fitzwilliam Museum. It consists of 13 colleges and 4 halls. Peter-house was formed in 1257; and Downing in 1800.

Though St. Peter's, the oldest college at Cambridge, was founded in 1280, this was a place of education as early as the Romans, but revived in the reign of Henry I. The system of education still pursued, too much resembles that of the Popish and dark ages, and changes of system do not keep pace with improvements; so that in all such establishments students do not acquire the knowledge of their own age, but only that of a previous age, or of the tutors' tutors.

There were, in 1828-9, on the books, at Oxford, 5163 members, of whom 2717 were students; and, at Cambridge, 5145, and 3088 students.

The Members of Convocation of Oxford, in Jan. 1831, were 2529; and the whole on the books, 5258; Christchurch, 951.

The Temple, London, was founded in 1185; Lincoln's-inn, in 1310; and Gray's-inn, in 1357.

There are four Universities in Scotland; St. Andrew's, of two colleges; Aberdeen, of two colleges; Glasgow and Edinburgh of one.

St. Andrew's University, founded in 1410, has two colleges, St. Salvator's and St. Mary's, for divinity only. Its students are 150.

Nearly 3000 students per annum attend the University of Edinburgh, where education and knowledge are acquired in the highest degree of perfection.

The University of Dublin, or Trinity College, has produced some learned men. It consists of a provost, 7 senior, and 18 junior fellows, and 70 foundation scholars. It has usually about 2500 students, and possesses a library 270 feet long, containing nearly 80,000 books.

The Royal College of Maynooth has 9 professors; 1 of dogmatick theology, 1 of moral theology, 1 of sacred scripture, and 1 of Irish.

Gresham College, sadly deteriorated, has 7 professors of branches of ancient learning, who lecture in term-time. It is under the direction of 12 of the corporation of London.

There are endowed Colleges at Dulwich, Eton, St. Bee's, St. David's, and Winchester; besides the Military, Naval, East India, and Sion; and Elizabeth, in Guernsey.

Two new colleges, on the plan suggested by Defoe, have recently been established in London, one called the London University, near Tottenham Court; and the other, King's College, in one wing of Somerset-house. The first is more particularly supported by the Dissenters, and the second by the High Church; but they are experiments on the population of a metropolis, and are not yet fully matured.

Universities, like societies, are favourable only to the propagation of the knowledge of the previous age, or ages, and to the perpetuity of established opinions. In general, too, as the dead languages were the language of literature when the first universities were founded in the 13th century, so, by precedent and usage, they continue their studies in those languages at a time when all knowledge out of their walls is in living languages. They preserve, too, the studies and cast of opinions which they enacted at the era of their foundation, and usually proscribe all improvements and discoveries as dangerous innovations.

The number of children receiving elementary education in England, in 1818, was near 1,100,000; and the returns, in 1828, make it about 2,000,000—1,500,000 between 5 and 12. The other 500,000 are presumed to receive education at about 10,000 independent schools, at 50 to each. But for education, the distressed circumstances of the country, since 1825, would have increased crime tenfold.

The first Infant School was opened by Mr. R. Owen, at New Lanark, in 1816, as an experiment, to teach children morals and facts without theology.

Besides parish and district schools, there are, in London, numerous large schools for popular and useful education.

During 1830, 328 English National Schools had been received into union

with the National Soeiety, making a total of 2,937 schools: and 6,643*l.* had been voted in aid of building school-rooms in 104 plaees. There eannot be less, in England and Wales, than 710,000 ehildren receiving instruction under the care of the clergy.

Christ's Hospital, London, boards, clothes, and educates 1200 children.

The Foundation Sehools of Harrow, Westminster, Merehant-Tailors, St. Paul's, the Charter-house, Rugby, and some others have, deservedly, great celebrity; but the systems of education are those of the age of Elizabeth.

The Number of Children educated at the great Publick Schools is as under:—

Christ's Hospital . .	1200
Eton	500
Charter-house . .	400
Winehester . . .	250
Westminster . . .	250
Harrow	200

The National Schools, in the spring of 1830, educated 275,000 children; the Lancastrian, 53,000; and there were 5000 Sunday Schools, for 700,000 children.

In 1828, the University of Berlin had 1706 students.

There are 400 students at the University of Kiel.

In the Russian Universities there are students:—Moseow, 891; Dorpat, 612; Helsingfoers (late Abo), 471; Charkoff, 318; Wilna, 303; St. Petersburgh, 311; and Kasan, 81. The eeclesiastieal high sehools attaehed to the Greek ehureh, are those of Kieff, Moseow, and St. Petersburgh, of whieh the first possesses 1500, the second 630, and the last 830 seholars. The whole of the students throughout the Russian empire are therefore 5957 in number.

The following is the number of degrees granted by the Scottish Universities in the last 31 *years:—*

	D.D.	LL.D.	A.M.	M.D.
Edinburgh	46	27	199	2,524
Glasgow	87	72	760	654
St. Andrews	69	6	59	649
Aberdeen	26	59	740	286
Marischal	31	50	881	282

PHILOSOPHY.

Philosophy has undergone four great ehanges:—1. A total subservieney to priestcraft and superstition, by the Chaldeans and Egyptians. 2. A commixture of reason and poetry, by the Greeks. 3. A mechanieal system, introduced by Copernicus and Galileo; and, 4, a system of poetieal, verbal, and imaginary eausation, taught by Newton, Lavoisier, &e. The world, at present, are divided between the two last; but reason demands the entire ascendency of the third.

The religion and philosophy of the Hindoos are eontained in a Book ealled *Anbertkend;* or, the Cistern of the Waters of Life; but they have nine sehools of philosophy, aneient and modern.

The first observers and recorders of nature were the Hindoos; the second, the Chinese; and the third, the Arabians and Chaldeans. But all reasoning was so mingled with priesteraft, that nature never was approached by eommon sense. Such has been the fate of philosophy always, even to our own times. It must not differ from theology, and therefore it makes no publick advanees. The schools, of our days, are more ignorant of proximate eausation, than able Greeks in the remote days of Thales.

Pythagoras, says Mr. T. Taylor, taught that all things result from matter and form, in harmony and symmetry, strietly geometrical and arithmetical. He taught that the elements of fire, air, earth, and water, were made up of atomick plane figures, indefinitely thiek, of triangular forms, sinee, from an equilateral triangle, and its division in the middle, he could form, by their combination, all the regular figures, and then these produeed different effects, as the pyramid fire and the cube earth. Every reader will see in this the germs of the modern theory of Hauy, an approach to the definite proportions of modern chymistry, and the last theory of Wollaston; while the mieroscopick observations of Link and Daniel tend to support the outline of the theory

The Pythagorians said, that num-

bers, from 1 to 10, govern all things, as—1. bound, or the infinite; 2. the odd and even; 3. one or many; 4. right or left; 5. male or female; 6. rest or motion; 7. straight or curved; 8. light and darkness; 9. good or evil; 10. square or oblong;—called the 10 co-ordinations.

Pythagoras taught the solar system, such as was revived by Copernicus.

Xenophanes asserted a first principle, finite and spherical.

Thales and Hippon called the first principle water, for the hot lives by the moist, and dry things perish; while seeds are moist, and aliment juicy. Thales left no writings but his Nautical Astrology; but he collected and edited the works of Homer.

Hippasus and Heraclitus taught that there was one moveable and finite principle, but that it is to fire which all things owe their rarity and density; and Heraclitus taught necessity.

Anaximander, the disciple of Thales, alleged that the infinite was the principle and element of beings, distinct from the elements and matter; and he taught that generation was the separation of contraries, through an eternal motion.

Anaximenes, that the infinite is air, which, divided, is fire; and, condensed, wind; then a cloud; then water, earth, and minerals, from which other things are produced.

Aristotle, the most elaborate of the Grecian philosophers, was a pupil of Plato. He was, by Philip, appointed tutor of Alexander the Great; and, after his pupil went on the Persian wars, Aristotle taught philosophy, in the Lyceum of Athens, with great renown, for 13 years. But, on the death of Alexander, the priesthood—the gods of whose interest he did not teach, but only the existence of one God,—raised charges against him, and fearing the fate of Socrates, he withdrew from Athens; and, in 319 B. C. he died in his 63d year. He was the author of 400 treatises, which he left to Theophrastus, his successor, with an injunction not to publish them. At his death, they became the property of his heir; and afterwards fell into illiterate hands, at Smyrna, where they were put in a cellar, and remained 150 years, till they nearly perished. They were then removed to Athens, and, in 86, sent by Sylla to Rome.

Diogenes Apoloniates ascribes all things to air, and he adopted an element between fire and air, apparently the gas or ether of the moderns.

Parmenides adopted two principles, fire and earth, or God and matter; the one active, the other passive, a near approach to the doctrines of the moderns. He used to say, that, although the priests and the people had so many names for God, and assigned so many properties, nature and philosophy knew but one: hence his line.

The one immoveable has every name.

Since, therefore, it was not generated, it is, and always was, and will be; and it is infinite, for it has neither beginning nor end.

A being unproduced, without decay, unshaken, single, whole without an end; nor once it was, nor will hereafter be, since it now is one simultaneous all.

Thales and Anaximander directed, says Simplicius, their attention to the prolifick vital nature of water: Heraclitus, to fire; Anaximenes, to air; and Anaximander to motion: owing to their different views as intelligible, sensible, or proximate, asserting different things in words, but not such as are contrary, to those who are competent to judge. Aristotle observes, that some assume prior, others posterior principles; and one appeals to reason and another to sense, with little general difference.

Plato and Aristotle were rather commentators than inventors of new opinions, though they conferred greater perfection; and Plato defined the intellectual God; while Aristotle states, that every thing which moves must have an immoveable mover, the first principle of motion, subsisting as a properly producing principle, and as eternally motive.

Empedocles admitted four elements, the principle of whose action was friendship and strife, or the

ttraction and repulsion of the moderns.

By friendship's aid, we sometimes with one
All things collect; and sometimes strife detains
All things apart, discordant borne along.

And these he makes co-ordinate with the four elements. Again, we have further confirmation in these lines—

And each with equal power is found endued,
When strife pernicious is from each apart,
And friendship equalized in length and breadth.

Plato taught three principles, the cause or mover, matter and form; or two, the cause and matter. He was, in other respects, of the school of Pythagoras and Parmenides.

Anaxagoras made corporeal principles to be infinite; and those of water, fire, gold, &c. were unbegotten and incorruptible, and parts of their own eternal kinds, governed by one cause of motion and generation—intellect.

Archilaus and Socrates made principles infinite, and ascribed generation and corruption to mixture and separation.

Leucippus asserted that atoms, the elements of all things, were infinite, and always moved; and that they were of various forms, thereby generating and characterizing different bodies in figure, order, and position.

Democritus and Metrodorus followed Leucippus; and added, that the full and the void are the first causes of things.

Zeno, Leucippus, Democritus, Protagoras, and Epicurus, were the inventors of the Atomick System, in which they ascribed the composition of all bodies to smaller, and smaller parts, in various forms, called Atoms, at present the principle of chymistry.

Anaximander, a Greek philosopher, who flourished in the sixth century B. C., taught that infinity of matter is the original cause of all phenomena, and that all things return into it. He made the first globe, and invented the sun-dial. He observed the obliquity of the ecliptick, and taught that the sun was 28 times larger than the earth. He thought stars animated by the divinity.

Anaximenes, another Greek philosopher, who flourished in the sixth century B. C., taught the infinity of air, or ether; that its activity was the cause of all things; and that it was in reality God. From it proceed fire, water, and earth, by rarefaction and condensation.

Anaxagoras, an Athenian, who flourished in the fifth century before Christ, taught that wind was owing to rarefaction; that the rainbow was owing to reflection; that the moon is enlightened by the sun; that comets are wandering stars; that the fixed stars were beyond the sun, &c.; many of them regarded as modern discoveries. He was persecuted and banished by the priesthood.

Aristotle taught the principle of virtual velocities; and, also, that time, space, and a vacuum were essential to motion, with the laws and varieties of which he was familiar. The energy of nature to fill up vacuities, he figuratively described as an abhorrence, but did not assert that there are no vacuities.

The Academical Philosophy is so called from Plato's place of teaching, a grove of one Hecademus bequeathed for gymnastick exercises.

Most of these opinions of the Greeks prevailed in the earliest books and schools of the Hindoos.

Edrissi, an Arabian geographer, in the 12th century, describes the earth as round, and gives its size as 11,000 leagues, or about 27,000 miles; and states, that Hermes had made it 36,000, which proves that the ancient Egyptians were familiar with the shape, and approximated the size. He imagined, that south of the equator was a region of fire; and beyond the 64th degree of north latitude, was a region of ice and darkness; the Atlantick he calls the sea of darkness; and the Northern Ocean, the sea of pitchy darkness. He describes England as a country of perpetual winter, and Scotland as an island.

Copernicus, in 1543, laid the foundations of modern science, by applying geometry to illustrate astronomy and cosmography. Galileo extended his method in explaining the acceleration of falling bodies, and the motions of a pendulum. Kepler, the pupil of Tycho Brahe, sug-

gested some new laws. Fermat, Gassendi, and Huygens, perfected and extended the views of their predecessors. Descartes suggested causes, and Hooke invented the theory of universal gravitation. Newton gave geometrical forms to the ideas of Kepler and Hooke, but adduced, as a proof, that the moon falls 16 feet per minute in her orbit, whereas she falls nearly 130,000; and he applied the law of superficial radiation to the celestial forces. Euler, Bernouilli, and Clairaut, illustrated the theory of comets; Lagrange and Lalande other curious points; and La Place systematized the whole by refined mathematicks, in his *Mechanique Celeste*.

The follies of philosophy have been the squaring the circle, the perpetual motion, the inextinguishable lamp, attraction and repulsion, the philosopher's stone, the universal solvent, the elixir of life, the influence of the stars, and the raising of spirits. These several subjects have, in the last 50 generations, absorbed the lives of at least 10,000 men in each, amid the veneration or fear of the vulgar of all ranks.

Galileo, the father of modern philosophy, in alluding to the general doctrine, in 1610, that the tides are occasioned by the *attraction* of the moon, says, "the tides are local and sensible, and cannot be brought to obey occult qualities, and such like vain fancies; all which are so far from being the cause of the tide, that, on the contrary, it is the cause of them, inasmuch as it creates the idea of attraction in brains more apt for loquacity and ostentation than for inquiry into the secrets of nature; and, who, rather than be driven to pronounce the wise, ingenuous, and modest words, '*I dont know*,' blurt from their tongues all sorts of extravagances." He referred the tides to the annual and diurnal motions; and, if he had superadded the moon on the same principle, his theory would have been complete.

Lord Bacon, who was one of the logical subdividers and generalizers of his age, ascribes the prevalence of errour to four causes, which he calls idols. His first idol was that of the *tribe*, by which he meant the popular errours of the human race; the next were those of the *den*, which were those of self-love and vanity; the third were idols of the *forum*, that class of errours which arise from the use of words, which, when analyzed, have not the sense imputed to them. His last class were idols of the *theatre*, by which he impugned the systems, forced on the world by schools and universities, whose publick parade tends to mislead the judgement. He also recommended, that experiment and fact should precede general inductions, a principle so obvious that it must have been recognised in every age. His own errours were however numerous; he attacked the system of Copernicus; he believed in witchcraft and astrology; he was supposed to be the editor of King James's Book against witches; and he decried the researches of Gilbert, the only experimentalist in his age.

The *instantiæ crusis* of Lord Bacon is, when a particular fact agrees with only one of two or more hypotheses. The *experimentum crucis* is, when a fact proves a particular hypothesis, and accords with no other.

The idea of a principle of general gravitation commenced with the ancients. Pythagoras stated, that the gravity of a planet is four times that of another which is twice the distance. Anaxagoras and Plutarch ascribed the circumstance of celestial bodies not falling together, to the rapidity of their motions; and Lucretius ascribed it to the infinite size of the universe. Copernicus ascribed gravity to the providence of the Supreme Being; and Galileo considered each planet as governing its own laws of gravity. Kepler says, that, if the moon and earth were not retained by some equivalent force, the earth would ascend a 54th part towards the moon, while the moon would move over the remaining 53 parts if they both have the same density. These are the fundamental principles of the modern doctrine of gravitation. But Dr. Hooke, in 1674, states distinctly that the heavenly bodies have an attraction or gravitation towards their own centres, which extends to other bodies, within the sphere of their activity; and that all bodies would

move in straight lines if some force like this did not continually act on Newton's Principia, which appeared in 1687, was palpably a commentary on these opinions.

The chief part of the Newtonian Philosophy, as delivered by the author, except his optical discoveries, &c., is contained in his Principia, or Mathematical Principles of Natural Philosophy.

1st law. Every body perseveres in its state of rest, or of uniform motion in a right line, unless it is compelled to change that state by forces impressed upon it.

2d law. The alteration of motion is always proportional to the motive force impressed, and is made in the direction of the right line in which that force is impressed.

3d law. To every action there is always opposed an equal re-action; or the mutual actions of two bodies upon each other, are always equal, and directed to contrary parts. Thus, whatever draws or presses another, is as much drawn or pressed by that other, &c.

From this axiom, or law, Newton deduces the following corollaries:—

1. A body impelled by two forces conjoined will describe the diagonal of a parallelogram, in the same time that it would describe the sides by those forces apart.

2. Hence is explained the composition of any one direct force out of any two oblique ones, viz. by making the two oblique forces the sides of a parallelogram, and the diagonal the direct one.

3. The quantity of motion, which is collected by taking the sum of the motions directed towards the same parts, and the difference of those that are directed to contrary parts, suffers no change from the action of bodies among themselves, because the motion which one body loses is communicated to another.

4. The common centre of gravity of two or more bodies does not alter its state of motion or rest by the actions of the bodies among themselves, and therefore the common centre of gravity of all bodies acting upon each other, (excluding external actions and impediments) is either at rest, or moves uniformly in a right line.

5. The motions of bodies included in a given space are the same among themselves, whether that space is at rest, or moves uniformly forward in a right line, without any circular motion. The truth of this is evident from the experiment of a ship, where all motions are just the same, whether the ship is at rest, or proceeds uniformly forward in a straight line.

6. If bodies, any how moved among themselves, are urged in the direction of parallel lines, by equal accelerative forces, they will all continue to move among themselves, after the same manner as if they had not been urged by such forces.

The mathematical part of the Newtonian philosophy depends chiefly on the following lemmas, especially the first, containing the doctrine of prime and ultimate ratios.

Lemma 1. Quantities, and the ratios of quantities, which, in any finite term, converge continually to equality, and before the end of that time approach nearer the one to the other than by any given difference, become ultimately equal.

Lemma 2. Shows, that, in a space bounded by two right lines and a curve, if an infinite number of parallelograms are inscribed, all of equal breadth, then the ultimate ratio of the curve space, and the sum of the parallelograms, will be a ratio of equality.

Lemma 3. Shows that the same thing is true when the breadths of the parallelograms are unequal.

In the succeeding lemmas it is shown, in like manner, that the ultimate ratios of the sine, chord, and tangent, of arcs infinitely diminished, are ratios of equality; and therefore that in all our reasonings about these, we may safely use the one for the other; that the ultimate form of evanescent triangles, made by the arc, chord, or tangent, is that of similitude, and their ultimate ratio is that of equality; and hence, in reasonings about ultimate ratios, these triangles may safely be used one for another, whether they are made with the sine, the arc, or the tangent. He then demonstrates some properties of the ordinates of curvilinear figures, and shows that the spaces which a body

describes by any finite force urging it, whether that force is determinate and immutable, or continually varied, are, to each other, in the very beginning of the motion, in the duplicate ratio of the forces; and, lastly, having added some demonstrations concerning the evanescence of angles of contact, he proceeds to lay down the mathematical part of his system, which depends on the following theorems:—

Theorem 1.—The areas which revolving bodies describe by radii drawn to an immoveable centre of force, lie in the same immoveable planes, and are proportional to the times in which they are described.

Theorem 2.—Every body that moves in any curve line, described in a plane, and by a radius drawn to a point either immoveable or moving forward with a uniform rectilinear motion, describes about that point areas proportional to the times, and is urged by a centripetal force directed to that point.

Theorem 3.—Every body that, by a radius drawn to the centre of another body, any how moved, describes areas about that centre proportional to the times, is urged by a force compounded of the centripetal forces tending to that other body, and of the whole accelerative force by which that other body is impelled.

Theorem 4.—The centripetal forces of bodies which by equal motions describe different circles, tend to the centres of the same circles; and are one to the other as the squares of the ares described in equal times, applied to the radii of the circles.

On these and such like principles depends the Newtonian mathematical philosophy. The author further shows how to find the centre to which the forces impelling any body are directed, having the velocity of the body given; and finds that the centrifugal force is always as the versed sine of the nascent arc directly, and as the square of the time inversely; or directly as the square of the velocity, and inversely as the chord of the nascent arc. From these premises he deduces the method of finding the centripetal force directed to any given point when the body revolves in a circle; and this, whether the central point is near at hand, or at immense distance; so that all the lines drawn from it may be taken for parallels. And he shows the same thing with regard to bodies revolving in spirals, ellipses, hyperbolas, or parabolas. He shows, also, having the figures of the orbits given, how to find the velocities and moving powers; and indeed resolves the most difficult problems relating to the celestial bodies.

In the second book, Newton treats of the properties and motion of fluids, and their powers of resistance, with the motion of bodies through such resisting mediums, those resistances being in the ratio of any powers of the velocities; and the motions being either made in right lines or curves, or vibrating like pendulums.

In the third book he demonstrates the frame of the system of the world.

The phenomena first considered are, 1. That the satellites of Jupiter, by radii drawn to his centre, describe arcas proportional to the times of description; and that their periodick times, the fixed stars being at rest, are in the sesquiplicate ratio of their distances from that centre. 2. The same thing is likewise observed of the phenomena of Saturn. 3. The five primary planets, Mercury, Venus, Mars, Jupiter, Saturn, with their several orbits, encompass the sun. 4. The fixed stars being supposed at rest, the periodick times of the said five primary planets, and of the earth about the sun, are in the sesquiplicate proportion of their mean distances from the sun. 5. The primary planets, by radii drawn to the earth, describe areas no ways proportionable to the times; but the areas which they describe by radii drawn to the sun, are proportional to the times of description. 6. The moon, by a radius drawn to the centre of the earth, describes an area proportional to the time of description. All which phenomena are clearly evinced by astronomical observations.

The mathematical demonstrations are next applied by Newton, in the following propositions:—

Proposition 1.—The forces by which the satellites of Jupiter are continually drawn off from rectilinear motions and retained in their

proper orbits, tend to the centre of that planet, and are reciprocally as the squares of the distances of those satellites from that centre.

Proposition 2.—The same thing is true of the primary planets, with respect to the sun's centre.

Proposition 3.—The same thing is also true of the moon, in respect of the earth's centre.

Proposition 4.—The moon gravitates towards the earth; and by the force of gravity is continually drawn off from a rectilinear motion, and retained in her orbit.

Proposition 5.—The same thing is true of all the other planets, both primary and secondary, each with respect to the centre of its motion.

Proposition 6.—All bodies gravitate towards every planet; and the weights of bodies towards any one and the same planet, at equal distances from its centre, are proportional to the quantities of matter they contain.

Proposition 7.—There is a power of gravity tending to all bodies, proportional to the several quantities of matter which they contain.

Proposition 8.—That planets perform their orbits between the said force of gravity and a centrifugal or projectile force originally implanted in them, and continue uniform owing to the motions being performed in spaces, so devoid of matter as not to oppose any sensible resistance; which projectile force was originally a rectilinear motion, from which they have been deflected into orbits by the attraction of universal gravity.

Proposition 9.—That as no mechanical cause can be assigned for the projectile force, none for the gravitating force, and none for the rotation of planets on their axes, so all those phenomena must be referred to the immediate agency of the Supreme Being.

These, and many other propositions and corollaries, are proved or illustrated by a great variety of experiments, in all the great points of physical astronomy.

The preceding system of Sir Isaac Newton being founded on the supposed attractions and repulsions of matter which are mechanically impossible; on a principle of universal attraction of gravitation, assumed on the alleged fall of the moon 16 feet in a minute, whereas it is 128814 feet; and on a miraculous projectile force acting in a vacuum, Sir Richard Phillips has, in contrast, promulgated a strictly mechanical system, in which the simple motions, and momenta of bodies among one another, are proved to be the proximate causes of all material phenomena.

Postulata 1. A body remains at rest unless impressed by another body in motion. 2. A body, impressed by a moving body, acquires motion. 3. The motion acquired is in the direction of the mover. 4. The force is exerted on the side opposite to the parts to which the body subsequently moves. 5. A body is in force, or has the power of moving another body only in the direction in which it moves. 6. Momentum, or force, is the quantity multiplied by the velocity. 7. After a body in motion has impelled a body at rest, the momentum of the mover is divided between the two. 8. After a body in motion has impelled a body at rest, the quantity moved is increased, but the velocity diminished. 9. Momentum being always divided, none is ever lost. 10. The display of any force or power is always evidence that some matter or body is in motion. 11. A body cannot act where it is not present. 12. A body cannot move another body towards itself, by impressing the opposite side where it is not present, *i. e.* there is no attraction. 13. A body cannot be moving one way, and be the cause of another body moving in the opposite direction, *i. e.* there is no repulsion. 14. Bodies may be in force from motion, though relatively at rest, when parts of a moving system, as in the cabin of a ship. 15. The force of weight is either the motion or propulsion of a body towards the centre of the earth. 16. Bodies in motion, in one direction, require greater force to turn them into a new direction, *i. e.* there is no vis inertia. 17. The power of bodies in motion, called action, being divided with bodies moved, called reaction, the quantity parted with is equal to that received, *i. e.* action and re-action are equal. 18. That the force of a body moving in gas is

transmitted through gas, by the motion acquired by the intervening atoms of the gas.

His fundamental principles are—1. That a great progressive motion of a mass, combined simultaneously with a less motion of rotation, produces a resulting aggregation of the parts, and a centripetal force in all the parts, which is directly as the absolute progressive velocity, and inversely as the relative deflecting rotative velocity.

2. That a progressive motion of any system of bodies immersed in a gaseous medium, which medium transmits the circular motions of a larger body to any less one, occasions the progressive motion to be a collapsing force towards the central body, and the circular motion to be a tangent force on the less bodies.

3. That motions, or forces propagated through gas, are, at different distances, inversely as the cube of the distance, and directly as the quantities of matter in the bodies and their velocity of motion. Because the intervening atoms receiving the motions, are as the spaces, and these are as the cubes of the distance; and the primary force is as the momentum, that is, as the quantity multiplied by the velocity.

4. That, in a progressing and rotating system, either the progressing mass of a revolving planet, or progressing planet and revolving satellite, or progressing sun and revolving planets, the centre alone of the planet, or major body, moves with uniform velocity; and all the rotations or revolutions are deflections, or added motions of the parts, produced by abstractions from the force of the centre, and, therefore, retard the motion of progression of the mass. Thus, the earth would move faster in its orbit if it did not turn round; and it would move faster if it did not impart the force which moves the moon; so with other planets and so with the sun.

5. That progressive absolute motion of a system of bodies, as the progression of a ship, vehicle, or planet, to which motion all its parts are alike subject, produces among the parts a force towards the line of motion, or line described by the centre of the mass; but other phenomena arise among the parts whenever any relative motion affects some of them more than others, as when the system so progressing is made to turn round its centre with velocities of the parts according to the distance from the axis of rotation; they will then exhibit peculiar mutual results, or actions and reactions towards the centre, determined by the ratio of their several relative and deflective motions, to their common progressive velocity.

Corollary 1. If the centre does not progress, but the force of rotation is derived externally, as from the hand, or a winch, then this force will be displayed in the flying off of the parts in tangents.

2. If there is only a progressive motion and no rotatory, then the parts will form a train, and seek with force the common line of motion.

3. Progression and rotation, simultaneously, correct both causes of dispersion; for progression collapses the divergent action of rotation, and rotation checks the tendency of progression to form a train.

4. If, as in a planet whose rotation is derived from its progression in a curved orbit, the velocity of rotation could be made equal to that of progression, the planet would become stationary; and, if the rotation were greater, the parts would fly off in tangents; but, while the progression is greater, the parts between both tendencies necessarily fall to the centre.

5. The force of rotation being derived from the force of progression, is, of course, always less, and therefore the parts of all planets fall towards the centre; or, if not falling, have the force called weight or gravis; and hence also satellites respect the centre of primaries, and planets the centre of the sun.

6. In such a system it makes no difference whether any part or side is moving before or after the centre, or direct, or contrary, or oblique, because no part or side moves by itself, but is in mechanical connexion with *opposed* sides, one being in direction *plus*, and the other in direction *minus;* so that the average or mean result of the two sides governs the whole in necessary equilibrium,

around a common centre determined by both motions, which centre is not deflected like the other parts, but is always moving with the uniform progressive velocity.

APPLICATION TO FACTS.

I. The earth moves in its orbit about 98170 feet per second, which, in a ratio with the diurnal rotation, may be taken as a straight line, then this rotation derived from the other is 1525.4 feet. Then taking O as orbit, R as rotation, and F as fall, we have $\frac{O}{R}=F=64.3488$, for the centripetal force of a body at the equator, taken as a line only.

II. But the rotation of a line or hoop being simply as the radius only, that of the equatorial plane is as the square, or area, of the diameter of the equatorial plane, and that of the whole revolving sphere is four times this area; consequently $\frac{O}{4\ R}=F$, or 16.0872, which is known, by experiment, to be the mean fall all over the earth per second.

Corollary 1. For other times, the continuous force produces acceleration by Galileo's law, as the square of the number of seconds.

2. As the acceleration is caused by two motions, so the fall would become equable in 189 seconds, when the velocity becomes equal per second to the rotative force of the sphere.

3. That the equation $\frac{O}{4\ R}=F$ applies to all planets, and is local and special in each, and F has therefore no connexion with any property of matter, called the attraction of universal gravitation.

4. That $\frac{O}{4\ R}=F$ is $O=4\ R\times F$, hence, the two last being known, we have the size of the orbit and distance of the sun.

5. A second is recognised as a standard time, because it is the first and last mean, the fall in half a second being four feet, and that in a second and a half 36 feet, 32 feet being the fall in this first second, of which a second is the mean, or 16 feet.

III. The centripetal effect is the same in the parallels as at the equator, because the force is as the square of the radius, and this is equal to the square of the sine and cosine every where; while their diagonals are the common radii. At the poles, the sine becomes the radius; and, at the equator, the cosine. The equation for different latitudes is $V\times\frac{R}{\text{cos. lat.}}\times 4$.

Corollary. All the parts of the *same* sphere must be equally affected, and all the actions and reactions directed to and from the common centre.

IV. $F\times R$ (4 R) being $=O$, so F and R are the sides of a rectangle equal to O; and as $F:\sqrt{O}::\sqrt{O}:R$, *i. e.* 16.08728 : 313.27 :: 313.27 : 6101.6. The first term being the known fall of a body; the second and third the square root of 98170, the mean orbit motion per second; and, the fourth, the rotative force of the whole surface.

V. As it is for bodies at the earth, so it is, by exact analogy, for the moon. The earth's momentum is the rectangle of its relative bulk to the moon 46.95, by its own velocity 98170 feet per second $=4609000$; and this rectangle is exactly equal to the square of the two equal forces, which produce the moon's true mean orbit motion of 3371.35 per second, found, by dividing 7958 millions of feet in orbit, by 2360591 seconds. For $\sqrt{46.95\times 98170}=2146.9=$ the sides of the said square, and $=$ the equal tangent and central force at right angles. Then 2146.9×1.5708 for the subtended equivalent arc, gives 3371.35 feet exactly. The distance is taken at 240,000 miles, but whether more or less all the results would equally accord.

Corollary 1. How gross the imposture then of founding a system on a fictitious fall of 16 feet per minute, the real fall being, exactly, 128814 feet per minute, while the equal division of the radius of the orbit gives 139,000 feet! How juggling, too, to compare a paper fall at the moon with a real fall at the earth; and how delusive, even under that juggle, to take a minute, when even the juggle itself would hold for no other time! How strange, too, to assign a fall of only 16 feet during a motion, ra-

pidly curved, of 202281 feet! But the wonder, after all, is far less, that a system-maker should be seduced to make the assertion, than that mathematicians, and men of moral worth, should, from 1687 to 1831, have been mistaken enough to believe, and teach such nonsense with solemn emphasis.

2. The satellite systems of Jupiter, Saturn, and Herschel would be governed by the bulks and orbit velolocity, like the above; but the rectangle would be equal to the squares of the forces of all the moons, and, in investigating them, it is convenient to consider them as a mean moon at a mean distance.

VI. As it is with the earth and moon, or planets and moons, so it is with a sun and planets. A moving system demands a moving centre; and, as aggregation and centripetation exist in the sun, though it palpably rotates, so it must progress through space, attended by its system, just as his miniature-system progresses with Jupiter. If the fall at the sun was the same as that at the earth, its rotation of 7418 feet per second would demand 474752 feet of progressive motion. But considering the rectangle of its bulk by its velocity, as equal to the rectangles of all known planets, or to the rectangle of a mean planet 590930000 miles distant, whose two equal forces would be 23610, the sun, 557 times larger, would have to move 1000000 of feet nearly; if more planets, and twice the matter, the motion would be 730,000 feet; or, if thrice, then 435,-500 feet. Hence, the motion is about 6 or 700 thousand feet per second.

Corollary. The sun, probably, obeys some motion of the cluster of the milky way to which it appertains.

VII. The orbits of planets are generated in location where the collapsing force to the centre, and the rotation of the gas of space, have equal force in accord with the magnitude of the mass. It is there moved within certain limits, varied mechanically, and independently of the primitive forces. When a planet starts from its mean distance, the two equal forces would move it in a diagonal right line; but the gaseous tangent force carries it outwardly, and it passes diagonally between the mean tangent of an incremental arc and its chord, every succeeding chord being equal to every preceding mean tangent. Then, as the end of one mean tangent joins another at the outer corner, and each is in succession directed outwardly, the distance increased till it becomes too great for both primitive forces; and, at 90°, the chord becomes equal to the mean tangent of the whole quadrant. The orbit being now too large for the first forces, the planet moves slowly, till the central or chordal force prevails, turning the direction and carrying the planet to the inner corners of the rectangles of the little arcs, till it arrives at the perihelion, where the forces so increase as to give ascendency to the tangent force, which carries it again to the outer corners, till it reaches the aphelion.

Corollary 1. The quantity which the planet is carried out by the tangent force referred to the radius, is the eccentricity; and an approximation of the series on these data, gives a sum which adds, as near as possible, ·0337 to the major axis.

2. The sun is the constant centre of every increment, and the centre of the solar system; the foci and orbits being merely pictorial.

3. This problem may also be considered in relation to the increase and decrease of the angle of 90°, which occur between the forces, as one of them decreases or increases the distance, a variation which would also account for the ellipticity.

4. The previous explication refers to mechanical causes, the variations of force; while it admits that variation of angle in the two forces, which, in Newton's explication of orbits, required only a mechanical origin to be satisfactory.

IX. The rotation of a planet is caused also by the same forces, one directed to the sun, and the other on the right-hand side, so that each affects half the planet, but both one quadrant; while its opposite quadrant is unaffected by either. The orbit, then, is in the direction from that quadrant to this other; and then, if the planet moved in the

usual diagonal, the centre would describe that line; but the line of direction is 5° 32′ beside the centre, and hence the rotation. Thus, the direction from the chord to the mean tangent, at once creates the curvilinear orbit and the rotation. In a quadrant, in round numbers, it occasions the planets to move through 1.5708, at an angle of 50° 32′, instead of 1.41415 at 45°, while the gross force, in the diagonal of the chord and the mean tangent, is 1.7316, at 54° 44′. Mechanically, in the phenomena of a planet, *cæteris paribus*, the earth's orbit force is a rectangle, formed by the mean tangent of a quadrant with its chord; of which rectangle a portion is the earth's orbit motion, or the rectangle of the diagonal of the chord and mean tangent; and the remainder of the first rectangle is exactly equal to the quantity of the rotation, and the eccentricity divided by the force of the obliquity.

Corollary. That, by the general action of the centrifugal and centripetal forces, we know that the resulting mean *tangential* force is as 8, and the mean *chordal* force as 5.656856, taken for the 4 mean quadrants. Then the planet oscillates, as it were, between these lines (acting as alternate chord and tangent) in an orbit, which, as a mean circle, would be 6.28318; but, as an ellipsis is in the earth .0337 more, or 6.3033. But the mean proportional of the tangents and the chords is 6.7214, and this *less* 6.3033, leaves 0.4181, for an *excess* of force not required in the production of the actual orbit, and therefore applicable to the whole rotation. In proof that it is so, $\frac{6.7214}{0.4181}$=16.08 the known ratio of the two forces; and further, in the earth, as 6.7214 : 0.4181 :: 585112000 (the whole orbit) : 36370000=365.24 × 24896 × 4. Hence, it appears, that such is the mechanical or geometrical harmony, and such the provision for the uniform organization of matter, that fall and weight is the same in all planets; and then, knowing the distances and circumferences, we can approximate the rotative forces, and the number of rotations or days in any orbit.

VIII. The ratio of the times and distances is not that promulgated by Kepler, for the forces in space, propagated in gas, are as $\frac{1}{D^3}$, not as $\frac{1}{D^2}$; and every planet is acted upon by two forces each, as $\frac{1}{D^3}$ at right angles. Their hypotenuse is the orbit, which, in times of D, governs the times, not the original force, or one of them. Then twice the square of $\frac{1}{D^3}$ is $\frac{2}{D^6}$, the square root of which $\frac{1}{D^{\frac{3}{3}}}$ or $\frac{1}{D^{1.5}}$, as the orbit force governing the times; which, being inversely as the force, T is as $D^{1.5}$. That is T : t :: $D^{1.5}$ to $d^{1.5}$. But T and $D^{1.5}$ being known in the earth, it becomes 1.83 × $t^{\frac{2}{3}}$ universally. That is, the distance of any planet from the sun, is the cube-root of the square of its period, multiplied by 1.83.

Corollary. The law $\frac{1}{D^2}$, adopted by Newton, because it resembled light and heat on a surface, would give $\sqrt{\frac{2}{D^4}}$, and T as $D^{0.5}$ which is absurd. He took one of two forces, instead of their result in the orbit which they produced, and which orbit force governs the times.

IX. The precession of the equinoxes, or falling back of the earth's nodes, and the advance of the line of apsides, are two different displays of the very same motion as their common cause. The earth, like every other body which goes round in a circle, or orbit, turns once on its own axis, as a mere consequence of its orbit revolution; and this motion is displayed in its orbit by an advance of the orbit itself, or in the apsides of the orbit, equal to a circumference measured in the stars, *i. e.* in the relation of the equator to the ecliptick; and, by an anticipation of the nodes as a mere terrestrial phenomenon, relatively measured and determined as to the stars in the relations of the ecliptick, to the terrestrial equator. The circumference of the earth, 24896 miles, is therefore an exact mean proportional of the two in quantity; and so, also, in angular motion; and

also in periods; 24896, in the ecliptick is 27141 for the apsides per annum; and, in the equator, is 22338 miles for the precession. That is, $C^2 = A. \times P.$ The angles are 50.1″. Precession 61.98″. Apsides, and their mean proportional, is 56.277″ for the circumference. And the periods are 25868 precession, 20910 aspides, and their mean proportional 23255. The angular quantities are 22382 miles and 27692, and still exact proportionals to 24896. The angular differences over the trigonometrical, in a year, are + 551 apsides—456 precession, and in similar ratio; while their mean, 501, is exactly what the moon would add, *i. e.* a 49th or 50th to each, or to the acceleration of the earth's orbit from its rotation on its axis in connexion with its satellite.

Corollary 1. The moon's mean circumference is 6836 miles, and her nodes fall back 5166 seconds, or 6800 miles, which, as above, reduced to the ecliptick, is 6836 exactly.

2. Of course, as the angle 56.277″, the mean proportional of the known angles 50″.1 and 61″.98, is=24,896 miles, so we determine the orbit, and that the mean distance of the sun is between 92 and 93 millions of miles, without considering the effect of the moon on the angular motion.

X. That Tides arise from the sensible yielding of the mobile waters to these reactions of the moon which carry the earth round the mechanical centre of both, and they are inversely as the angle of the earth's orbit motion to the direction of the said reactions; while the opposed tides arise from the necessary equality of the two sides of the rotating earth, so that if one side is enlarged by a tide, (the earth's centre being a point determined by greater forces,) then the mobile waters on the opposite side rise mechanically by the force of the opposite side, and restore the equilibrium of bulk and momentum of both sides.

XI. That, from similar causes, the reaction of the earth to the sun, which is first displayed by the mobile waters, these are most affected in the perihelion, and least in the aphelion; and hence the perihelion demands in its line of action the centrifugal force of more water than the aphelion, by which the seas follow it from hemisphere to hemisphere, as it varies its declination. Its declination is now in 23° south, and therefore the seas preponderate in the *southern* hemisphere; but when, in less than 10,455 years, the declination becomes 23° north, the seas will then equally preponderate in the *northern* hemisphere. The difference of force is as 11 in the perihelion to 10 in the aphelion. These regular alternations of the seas are, therefore, the chief cause of the various land and marine strata, while it appears, from their succession and number, that the perihelion must many times have progressed around the ecliptick in periods of 20,910 years.

Corollary. Of course, as quantities of intervening gas are moved by the central force, and as the same force will move only the same quantity in the same times, the dimensions, or area, of the volume of moved gas, must in the same times be equal; but the proposition is only an amusing harmony, because the orbits must be as the forces, greater when nearer, and less when farther off.

XII. That as comets, however they originate, pass through the solar system generally at high angles, so their deflections are created by the sun's diffused action in his sphere of action, which is inversely as the cube of the cosine and as the sines. In like manner the perturbations of the planets are inversely as the cube of the cosine of their spheres of action, and as the sines subordinate to the solar force. On this principle all the orbits of comets may be reduced to the utmost degree of precision. So, also, with the perturbations of the planets themselves, their orbs of action interfere inversely as the cube of the cosine and as the sine of their latitudes.

Cor. The sun being the centre of the system, and all the motions in it being abstracted from the sun, whose motions are a remainder, so, the sun's motions admitting of no modification from the parts, any disturbances among them are speedily corrected by the absolute force of the centre.

XIII. Facts do not enable us to

determine the cause of the sun's progression, but that progression is the proximate cause of the orbit revolutions of the planets, while their rotations on their axes are abstractions from their own orbit velocity; and the momentum of each planetary mass is then the source of all the motions, combinations, powers, actions, re-actions, vegetable, and animal life, &c. &c. which are displayed by its parts and atoms on its surface or elsewhere. All these are so many deflections from, and excitements to, the terrestrial momentum, and they begin in it and are ultimately returned to it; while the terrestrial momentum is itself part of the momentum of the sun, which fosters, by its light and heat, (the momenta of its atoms) all those multitudinous phenomena which it generates by the momentum of its mass. Such is the scheme of nature—such the solar, and perhaps the general, system of the vast material universe.

XIV. That other pretended proofs of an absurd principle of attraction are almost beneath contempt. In an elastick atmosphere, its pressure on bodies is in right lines, and the force inversely as the cube of the lines. If the lines then, on one side, are shortened by any interception, the longer lines of force on the opposite side press the body towards the intercepting object. In this way floating corks intercept each other's pressure, and go together; so boats incline to intercepting ships, plummets to intercepting mountains, and nicely-poised lead-balls, and drops of water and mercury, yield to each other's interception. This law, and fitting forms, are the causes of all chymical attraction, and of the ascent in capillary tubes; while the attractions of electricity and its modifications in galvanism and magnetism, arise from a separation of atoms usually in fit combination; and the effort to restoration affects bodies placed in the space in which the effort exists. The whole is mechanical, and, in reasoning, we must consider in all cases the *modus operandi;* or, we only *mystify and obstruct inquiry, and have no real knowledge.*

Space, according to this system, is the extension of matter, or of matter in motion, or, in fine, the extension of *material power;* every equal space having within it equal momentum, or a tending to equality, created by more matter and less motion, or by less matter and more motion.

There is no space void of *material power*, owing to the elasticity or orbit motions of atoms of gas, which enlarge as any space presents itself, that is less filled with power than any other space, as in the pores of bodies, and spaces between the planets and stars.

Matter, under all circumstances, is in great motion. In solid forms in a planet it moves with the planet, and presses mechanically towards the centre of motion. By rotation, velocity is superadded as density lessens, or as distances from the centre. In fluids and gases, its atoms also are in great intestine regular motions; motion taken away produces fixity, or imparted confers fluidity.

Motion is transferred from body to body, because bodies in motion unite or conjoin with others, and when these are at rest the bulk is merely increased, and the velocity is continued of the whole inversely as the new bulk to the old; and when the transfer is effected by a change to intermediate atoms as in gases, and then by these to a body at rest, the transfer is as the number of atoms diffusing the motion, or inversely as the cube of the distance.

Impulse, or *impact*, moves a body at rest, because, for a moment, that body partakes of the momentum of the impeller; and the motion is continued, because, in advancing a body creates a nascent vacuum in its rear, which other matter closes with force, and the motion only abates by the transfer to the atoms encountered in front.

As every body parts with its motion only to other bodies which then display it, so *action* is transferring motion, and *re-action* is receiving what is transferred, both therefore equal. *Percussion* is one mode of parting with motion, *Friction* another, and *Resistance* another, all resolvable into mere union. *Reflections* and *Deflections* arise from

the velocity being parted with only on the striking side; and direct *rebounding* arises from the striking side parting with its motion before the rear side, which produces a continuous blow. *Inertia* is the mere consequence of all matter being in some previous motion to that in which any new force is applied, for without motion, matter has no kind of force.

Past mistakes and controversies, about Space, Time, Power, &c., have risen from inattention to *Gas*, and ignorance of its construction; about motion, from its being supposed to be lost when invisibly continued in gases, or being pretended to be renewed by such fanciful powers as attraction, repulsion, fermentation, or fire; and about Time, from no physical effects being ascribed to the motions of the earth as a planet.

Time is the sensation or perception of the earth's motions, the sensations succeeding, step by step, as the motions proceed; and Time is measured by cycles of the phenomena, as days, moons, and years. In other planets, Time is measured by their particular motions; and Time and Duration are universally measured by motions, and are merely the sensations which accompany them in succession as cause and effect.

Motions, changes, and phenomena on the earth, or any planets, are entirely caused by the motions of the earth or planets, derived from them, and returned into them. The annual and diurnal motions create, cause, include, and absorb the entire events, progress, and history of all organized beings, their motions and phenomena being mere deflections of the motions of the planet with which they are connected. And the motions of the sun create the motions of all the planets.

The personal and identical *Sensations* of animals are mechanical results of their whole healthful organization and vitality; and *reasoning by analogy* is a necessary result of individual experience and education from imbecile infancy, essential to preservation, and to the beneficial use of the limbs, &c. as proveditors for the contained polypus or *absorbing stomach*; every animal being radically a polypus, with a body of compound feelers, and a medullary system for perception and reasoning by analogy, those powers being essential to the due use of the feelers, or limbs and other adjuncts to supply the polypus, or stomach, with food, soil, excitement, or manure.

What is called intellectuality, is a result of power always and essentially material. Power is the original generick perception, and the root of all others in species, sub-species, and varieties. It produces the perception of *feeling* mechanically from the action of masses; and then the eyes, ears, nostrils, and palate economize, characterize, specialize, and assimilate to the medullary system the actions or power of atoms, while the re-actions of the parts conveyed to the brain, or ganglions, are sensations, and their reflections what we call perceptions. Power, or matter in motion, therefore, is the primary and immediate cause, not only of all physical effects on the largest scale, but also of all organization and assimilation of parts, and of all medullary energy or mentality. The universe is power displayed in and upon a system and systems of matter producing all phenomena, by laws arising from varied cross, and reflected simultaneous, displays of itself.

Generick causation, or excitement, is some matter in some motion; and all human or animal ideas result from the economization or appropriation of this general cause and its varieties by the instruments of the senses, which generate or create peculiar ideas of light and colour, sound and tone, taste and smell, all of them varieties of feeling, which is mere impulse, or percussion on the nervous or medullary system. Nature has but one mode of action, varied in intensity; and the varied nervous perceptions of that mode are created by the instruments of the senses, which uniform perceptions, as such, are generated or created by the powers of the sensual instruments, and constitute, according to this system, animal experience, education, and knowledge.

Attraction, or the principle of action by which bodies are imagined mutually to affect one another, so as to

move towards each other, is, in all cases, an utterly impossible mode of action; because each of the bodies, in going towards the other, requires to be impelled from its remote side where the other body is not, and where, of course, it is not in power.

Every case of sensible going together and sensible separation, has therefore some special cause, the examination of which constitutes the knowledge of nature; while the use of the terms, without the examination of the cause, veils knowledge in a circle of ignorance.

Gravitation, as a supposed innate power, was noticed by the Greeks; and particularly by Seneca, who speaks of the moon's attracting the waters. Kepler enlarged upon it; also Fermat. After which, Dr. Hook published it as a system; and it was subsequently adopted by Newton: but it is evidently of the same nature as witchcraft or enchantment. It is a presumption of a cause, without mechanical connexion of the cause with the effect.

Repulsion, or the principle of action by which bodies are assumed to repel one another, or by their mutual action push each other to a greater distance, is universally an impossible mode of action; because each of the bodies, while moving from the other, is in force only in the direction in which it is moving, which is contrary to the direction of the other body.

Bodies are accelerated by any force constantly acting. The velocity is equal to twice the distance multiplied by the time. The distance equal to the distance in one second, by the square of the time. And the time equal to the velocity, divided by twice the distance in a second.

Plenum signifies space, completely filled with matter; and *vacuum* a space entirely devoid of matter. Neither is probably the fact; but space is filled with power, *i. e.* by atoms, whose motions enable them to occupy every space, with power to the local exclusion of other matter not in greater power.

All the forces of nature may be explained on the principle that *they are matter, or atoms in velocity*, or are immediately moved by such; and astronomical and chymical phenomena are all reducible to this simple and universal mechanical principle. The fall and weight of bodies are owing to their being part of a system, or spherical aggregation in orbicular and rotatory motion. The planetary motions arise from the radiation of a central force as that of the sun, in a medium which occupies space. The elastick force of gas arises from the atoms being in circular motions, and all animal force and all heat arise from the concentration and appropriation of those motions. We live upon a world in motion, and within a world of atoms in motion.

Mathematicks examine and properly treat of abstract number and quantity; and can legitimately be extended only to mechanical action as motion (number), and matter (quantity), the rectangle of these being momentum. They serve also as symbols to illustrate. But it is gross sophistry to mingle mathematical science with any assumed powers not mechanical, or within the scope of mechanical investigation, while this is the ignominious practice of all modern physicks.

Forces which are not supposed to be derived from other motions, are, of course, original and miraculous; and such are those taught by the philosophy of the dark ages, called attraction, repulsion, gravitation, and the like.

Sympathy or affection, and antipathy or aversion, mere mental or nervous phenomena, are, by a false analogy, allied to attraction and repulsion; and to this supposed analogy, is owing the popular belief in these pretended qualities of most matter.

Most natural phenomena have, for two centuries, been explained by conferring gratuitous powers on the natural agent corresponding in name with the phenomena; but, it may be justly questioned, whether the agent is not single and simple, and whether the re-agents are not in most, if not all cases, the causes of the peculiar phenomena. Thus, heat is ascribed to heat-making atoms; bodies, going together, is ascribed to attraction; life, to a principle of life; tangent motion, to projectile force, &c.

Some phenomena, whose explica-

tion is not easy, present themselves, and, instead of connecting them by due research in mechanical science, the powers of witchcraft are invented, and all nature is then mystified instead of being explained.

The errour of faith, in witchcraft and enchantments, lay in the belief of causes not proximate, mechanical, and immediate, either by actual contact or material intervention. Masses and atoms are alike acted on mechanically.

When we speak of oxygen, nitrogen, and hydrogen, we merely give names to various elementary powers, and do not precisely define. The words are often abused by inadvertency. When we say that hydrogen fixes oxygen and generates heat, we do not exactly mean that the hydrogen and oxygen of our experiments so combine; but that some combination of some property, always allied to oxygen, combines with some property always allied to hydrogen. This property we call the principle of each, but from that principle our observations may be very remote. So, if oxygen and nitrogen produce electricity, we are not to refer to our oxygen and nitrogen, but to some ultimate fundamental principle of each, which nature detects. If each produces light and heat, these in fire and electricity are as different as hydrogen and nitrogen; and the oxygen being common, the differences arise from some variance in the fundamental principles of hydrogen, and nitrogen when combining with oxygen. In burning and flame, carbon is a necessary adjunct; and, in electricity, it is seldom, if ever, the mere re-combination of oxygen and nitrogen; for in air there is aqueous vapour, and different substances employed as conductors, afford different colours and intensities, arising, no doubt, from the elementary principles combined. We believe that oxygen, nitrogen, and hydrogen, are merely elementary atoms in different degrees of motion; but there may be different kinds of atoms in the same motion, or both—(but we may be wrong)—only the hypothesis seems to explain the phenomena plausibly.

Among modern metaphysicians, Gassendi taught that all our ideas are derived from, and compounded of, sensations. Hobbes taught the same; and Locke followed them, superadding *Reflection*, or ideas derived from the operation of the understanding, posterior to ideas derived from sensation.

Leibnitz taught *a pre-established Harmony*, by which the mind contains general notions and truths, like the plant in the seed, so that, according to him, "every thing goes on in the soul as if it had no body; and in the body as if it had no soul." Malbranche maintained, that the communication between the mind and body was a constant miracle, arising from the immediate agency of the Deity.

Opticism, or the doctrine that this is the best of all possible worlds, was an inference from *the pre-established harmony*, which was assumed to be formed by the Deity, and therefore perfect. Another phrase of Leibnitz was *the law of continuity*, meaning that motion is never lost, which, extending to soul, he maintained that it never ceases to think even in sleep or in a fit. Nature, says Helvetius, never proceeds *per saltum* (never jumps), and the law of continuity is exactly preserved.

The two great principles of Leibnitz were, that it is impossible for a thing to be, and not to be, at the same time; and that nothing is without a sufficient reason why it should be so, rather than otherwise.

Descartes taught a plenum of matter; and Spinoza the divine omnipresence, in that matter which he called *the soul of the world.*

Collins taught that a man can do as he wills or pleases; but that he is determined by his reason and his senses, *i. e.* differently from the absolute necessity of mechanicks or physicks.

Berkeley maintained that the existence of matter was purely ideal, and supported this by certain inferences of the mind during vision.

Sir Isaac Newton avowed his object to have been, the proof of the existence of God, which was necessary to the miraculous powers of attraction, repulsion, gravitation, *vis inertia*, and projectile force, with which he clothed matter and the

planets. He rejected the law of continuity, and considered those powers as restoring lost motion.

Space and Time, says Law, have no external representation or objective reality; and these ideas, as well as infinity and number, are created by powers of the mind.

Hartley taught, and Bonnet after him, that the ideas were communicated to the mind by vibrations, assisted by a subtile elastick ether, with which the nerves are imbued.

Helvetius ascribes the differences, in the minds of men and brutes, to bodily conformation and organization; Blumenbach, to the different quantities of the medullary substance in the brain. Gall, to the parts of the brain principally developed. Cuvier agrees with Blumenbach and Helvetius.

Mr. Hume rejects, or doubts, all knowledge not derived from the senses, *i. e.* those ideas derived from reflection, or the operations of the understanding; and, to get rid of the causes invented by Newton, and which he was told were demonstrated, he denies the assumed necessary connexion of cause and effect.

Dr. Reid controverts the theory that sensations are the only objects of thought, and that perceptions are images, or pictures in the mind, and conjoins innate principles as powers, which he calls common sense.

Leibnitz says, a substance is a thing capable of action, and a compound substance is an aggregate of *monads* which have no parts, and are neither extended, figured, nor divisable, being the real atoms of nature or elements of things.

The metaphysical philosophy of Kant consists in six axioms:—1. Consciousness or egotism. 2. Time, the *form* of internal sense. 3. Space, of external sense. 4. Sense for intuition. 5. Understanding for conceptions; and 6. Reason for ideas. Intuitions are, he says, present in time and space; Conceptions absent in time and space; Ideas, things out of time and space; and the three generate mind. He then asserts, that *time* and *space* are in the mind, and are the receptivities of *sense*. *Understanding* he refers to the four categories of quantity, quality, relation, and mode; and their species, unity; Many, the whole; Existence, negation, size; Property and Accidents, cause and effect, action and reaction; Possibility, certainty, necessity. Reason, he founds on the categories in their absolute sense, as totality, limitation, substance, cause, concurrence, necessity.

Philosophy is divided, by Kant, into Physicks, Ethicks, and Logick. The two former are *material* sciences, which take cognizance of external or internal facts; whereas the latter is purely *formal*, and treats only of the *form* and connexion of our thoughts.

Sense is the faculty which receives the matter of all the phenomena of nature; it is therefore *passive*, and has only two modes or forms of receiving. It consists therefore of the two receptivities, time and space.

Reason is a faculty that acts quite independently of time and space, by its *six pure activities*, which are the Six Ideas—Absolute Totality; Absolute Limitation; Absolute Substance; Absolute Necessity; Absolute Cause; Absolute Concurrence.

Mathematicks is the science of the laws of the *Sensitive Faculty*, or of the two mental receptivities, Time and Space.

Metaphysicks is a pure rational science that contemplates the rational grounds of all that presents itself to the mind. Hence we have metaphysicks of nature, or the sciences of ontology and cosmology; and metaphysicks of morals or the sciences of psychology and theology.

Philosophy investigates the faculties of Sense, Understanding, and Reason, and their results, *Intuition*, *Conception*, and *Idea*, together with their application. Intuition, present in Time and Space. Conception, absent in Time and Space. Idea, out of Time and Space.

An Intuition is every thing *present* in Time and Space, that we feel, see, hear, taste, or smell.

A Conception is every thing *absent* in Time and Space, that we think of only, but do not touch

An Idea is every thing *out of* Time and Space that we think of only, but which can never come into Time and Space.

This philosophy teaches that we have knowledge *à priori* which is both universal and necessary, and is therefore not derived from experience; that objects are only given to us by the united operations of sense and understanding, and that reason itself has the power to generate pure knowledge *à priori*. The object of the "Critick of pure Reason" being to establish that we have synthetical judgements *a priori*.

Of all the matter that is given to the mind, it is impossible to meet with any that is not contained in the two receptacles Time and Space. Therefore Time and Space contain the sum and substance of all our knowledge, and Time and Space themselves exist in the mind, for as knowledge really does exist in the mind, that which contains it must be in the mind also; hence Time and Space, say the Kantesians, are in the mind.

Mr. Locke ascribes the alleged inferiority of the reasoning powers of brutes to their inability of abstracting or making general ideas; but other writers doubt whether men ever make such; and most of them admit that all animals reason by analogy, because old ones are more sagacious than young ones, and because few of them incur a second time a danger they have once experienced. What are called habits and instincts, appear to arise from construction and capability, producing resulting practices, which the experience of generations proves to be the most fit and convenient to their power and natural constitution.

Locke's doctrine, that we have no innate ideas, and that all our ideas are compounded of sensations, was previously taught by Gassendi and Hobbes. "External objects," says Mr. Locke, "furnish the mind with the ideas of sensible qualities; and the mind furnishes the understanding with ideas of its own operations."

Logicians teach five rules of conception, or perfect reflection, as follows:—

1. Conceive of things *clearly* and *distinctly* in their own natures.

2. Conceive of things *completely* in all their parts.

3. Conceive of things *comprehensively* in all their properties and relations.

4. Conceive of things *extensively* in all their kinds.

5. Conceive of things *orderly*, or in a correct method.

Hence every perfect idea includes clearness, completeness, comprehensiveness, extent, and system or order.

Astrology is an errour, because it connects certainties with mere probabilities; but not such an errour, as very ignorant though popular writers would make it. For example, no astrologer views the heavens in making predictions; but merely consults an ephemeris, for it seldom happens that half the planets are above the horizon, and, if so, no eye could fix their positions. Nor is the erection of a horoscope of the twelve houses, or equal divisions, an affair of calculation, but it is formed in a few minutes. Only the slightest knowledge of addition and substraction is required, and the pompous nonsense in books and novels proves, to demonstration, that the art practised by these writers of connecting words and paragraphs is altogether distinct from knowledge of their subjects.

Astrology, prophecy, &c. imply fate; but the mistake arises from this principle, that all possible events are within a certain probability. If, then, 100 events are foretold with various probabilities of coming to pass, a certain number, as half, a third, or two-thirds, must always happen as foretold; and however or by whatever means foretold. The means merely relieve the prophet from the palpable imposture of inventing his prognosticks. One means are as good as another for this deception on the understanding; and whether 100 probable events are foretold by the sediments of tea-cups, planets, entrails of birds, shuffling of cards, dreams, pricking in a book, or moles on the body, some 30, 40, 50, or 60, are equally likely to come to pass.

There are two species of necessity often confounded and mingled, physical and moral, but really distinct. The laws of nature are imperative, and hence the government of physical necessity; but the moral, social, and personal relations of man are indifferent to nature, and therefore perfectly free.

It is proper to distinguish between facts or certainty, and what is called fate. A thing is what it is, and is not another thing. This is a mere fact. An event happens one way, and not two ways. This also is a mere fact, and nothing but the mere fact. But the causes, or actions and reactions, are independent of each other, and various in kind; and therefore the production, or event, is distinct from any of the preceding causes taken separately, while each of them are independent of the others. To constitute fate or destiny, the causes which go before the result must be as necessary as it, and concurring for that special purpose. There is a general *certainty* that there must always be *some* result; but some result is not a special result, which, therefore, is not necessary.

In animal actions, the judgement, decision, and action depend on the fluctuating and variable experience of the animal, as a selfish individuality or microcosm, and therefore no animal decisions or actions are necessary.

The final cause of animal existence in such variety and numbers, is their reciprocal use to each other in fructifying the soil, and adding to the natural food in vegetation. This they effect by respiration, and by chymical decompositions in the laboratory of their bodies. Without their excrements and remains, the soil would become arid, and all the pabulums of vegetation would be volatilized and dispersed. Hence, nature peoples every leaf, flower, stem, and pore, and the end is effected by the countless multitudes. They manure the soil, sustain vegetation, and, in return, vegetation sustains them. It is a circle of existence, in which each part and every link is useful and necessary. The manure of insects and animals converts soil into vegetables, and these again sustain animalization.

When water is raised into steam, we see, by the microscope, small spheres like bubbles formed; and this is always the form which aqueous vapour assumes while evolving from its mass of fluid. It is therefore to be suspected, that these spheres consist of atoms in various excitement of rotation, like the atoms which form the surface of a planet. They are products of the excitement which produced the evaporation, and then this excitement being motion, any cold body, or medium, takes off the motion of these little spheres, and they then fall together in drops. This seems to be an analogy by which we may infer the structure of all gases. It is difficult to conceive the orbits of simple atoms, and in this way, as spheres, all may work together, and the different parts of these spheres may, in power, constitute what we call elements. The equatorial parts the more active, and the polar the more sluggish. The oxygen of the atmosphere may be in equatorial activity, and the nitrogen in relative inertness.

The perception of objects is made by impressions on the intermediate senses; but strong recollections often reverse the process, and perception creates on the sense an impression equivalent to the usual external action. Often, too, the senses become diseased and perceptions arise from the disease and excitement of the sense. These are, and have been, the causes of all those mistakes and illusions which ignorance and superstition have ascribed to supernatural agency. Hence all the ghosts, visions, knockings, &c. &c. when not frauds and falsehoods.

In physiognomy a habit of mind begets a cast of features, by which the mind may often be inferred. So the development of parts of the brain enlarges the power of those parts, if opportunities favour, and some general deductions may be made; but not with the precision assumed by phrenology or craniology.

That perception, memory, volition, and all the mental phenomena, are in some way associated or dependant for their healthy action on the brain, cannot be for a moment questioned.

Herman Goltz passed many years in anatomical examination of that delicate viscus, the dead brain, endeavouring to discover some coincidence between its marvellous structure and its important uses. To this end, the whole concentrated force of his acute intellect was directed. Sometimes he was elevated by the hope that he had ascertained the source of the reasoning faculty, and the seat in which the passions are generated; but these gleams of success were transient, and were succeeded by total obscurity. At one period, he conceived that he had actually drawn aside the curtain, and beheld the mysterious processes that are performed in the occult laboratory of nature; but he confessed himself deceived, and afterwards cordially acknowledged that the curtain itself was a mere delusion. Exhausted by these sudden alternations of hope and disappointment, the fabrick of his understanding gave way, and, in a moment of despair, he hanged himself in his dissecting-room, and was nearly devoured by the rats before his loss was discovered and his fate deplored. Before he accomplished his last resolve, he wrote on a slip of paper these impressive words: "For more than *twenty tedious years* I have pursued a phantom, an *ignis fatuus*, that has decoyed me into ruin and misery. My vision has become so dim, that I can no longer distinguish the objects of my research; my hand is too tremulous to hold the scalpel. Confined in this charnel-house, I have been estranged from nature's fair and inviting prospects; I have cultivated no man's friendship, nor sought for the affection of woman. I have indeed read of the charms of society, the exhilarations of wine, the delight of a domestick partner, and the blessedness of children: but I have been a solitary student; water has been my only beverage; no females can reproach me with professions, nor can a child curse me for existence. To live longer is useless; the past has been misemployed; the present is wearisome, and I will anticipate the future."

The notion we annex to the words, matter and mind, says Stuart, is merely relative. If I am asked, what I mean by matter, I can only explain myself by saying, it is that which is extended, figured, coloured, moveable, hard, soft, rough and smooth, hot or cold; that is, I can define it in no other way, than by enumerating its sensible qualities. It is not matter or body which I perceive by my senses, but only extension, figure, colour, and certain other qualities, which the constitution of my nature leads me to refer to something which is extended, figured, and coloured. The case is precisely similar with respect to mind. We are not immediately conscious of its existence, but we are conscious of sensation, thought, volition—operations which imply the existence of something which feels, thinks, wills, &c.

POLITICAL ECONOMY.

Political Economy is a speculative science, whose data are often vague, and conclusions subject to the errours of system. When founded on arithmetick its reasonings do not in general apply to society, which is a compound of facts, affections, and passions, not to be controlled by the despotism of figures; while the multiplied relations of society constantly baffle isolated considerations. Nevertheless, it has corrected some errours, and established a few truths amidst a greater number of absurd and mischievous dogmas.—Some of its more popular truths are the following:—

That national wealth does not consist in mere money or coin.

That what one nation gains by commerce or manufactures, another does not lose.

That national superiority does not depend on repressing the industry, and impoverishing the resources of other nations.

That it is not better to make at home every thing we want, rather than permit other nations to profi by selling to us.

That national prosperity is not to be judged of by the balances of trade, as represented by custom-house entries.

That statesmen and legislators do not know better how to direct th various branches of industry, and the

employment of capital, than the individuals who draw their subsistence from them.

That commerce and manufactures cannot be aided by artificial restrictions, limitations, and modes of taxation.

That no country can be enriched by compelling the people to purchase, during an indefinite length of time, inferiour commodities at exorbitant prices.

That capitals cannot be changed in their direction, and forced by governmental regulations out of their habitual channels, without injury to individuals, and disadvantage to national wealth.

That population is not always and by all means to be encouraged.

That luxury and profuse expenditure, by encouraging industry, are not beneficial to a country; and frugality the reverse.

That taxes impoverish a nation, though spent at home.

That high taxes are injurious, though they urge to great exertion; and, though spent at home, do not foster industry.

That governmental expenditure does not operate merely like taking money out of one hand to put into the other.

That a national debt is a national curse; and paper money synonymous with destitution.

That colonies are not advantageous to the mother-country, owing to any monopoly they afford.

That chartered companies, exclusive privileges, and monopolies, are injurious institutions, in regard to commerce and manufactures.

That national splendour is no sure sign of national wealth and national happiness.

That the prosperity and increasing riches of manufacturers is not the same thing as national prosperity.

That we should not make laws to increase the wealth and influence of great capitalists, and put the poor who work for them more completely under their subjection.

We ought not so to frame a national system, as to make the rich richer, and the poor poorer.

That it is expedient to allow an industrious man to purchase the articles he stands in need of, at the best market, and the cheapest rate.

That laws ought to operate with equal advantage to all classes of the community, and protect all classes equally.

That restrictions, high duties, and prohibitions on imported goods, do not render domestick manufactures cheap.

That restrictions, high duties, and prohibitions are not necessary to furnish employment for our people at home: agriculture and commerce, and the trades connected, being adequate for that purpose.

The best patriots are the advocates for free trade, and free ports among all the nations of the earth.

The first book of the modern principles of political economy, was the treatise of Sir Dudley North, in 1691, entitled "Discourses on Trade, principally directed to the cases of interest, coinage, clipping, and increase of money." Nothing of importance appeared in England from that time till the publication of Sir James Steuart's Principles of Political Economy, about the year 1768, which was completely superseded by Dr. Adam Smith's Wealth of Nations, in 1776. Political Economy was first treated as a science by the French "Economists;" at the head of whom was Dr. Francois Quesnay, Physician to Louis XIV.; who was born in 1694, and died at Versailles in 1774, at the age of 80. In 1758 he published his Tableau Economique, et Maximes Generales du Gouvernement Economique.

Dr. Quesnay was followed in the same career, by the Marquis Mirabeau the elder, M. Merciere de la Riviere, M. Dupont Nemours, M. Turgot, and his biographer Condorcet.—They did much to introduce the genuine principles of free trade, and the liberal notions that characterize the modern science of Political Economy. From this time to the publication of Dr. Adam Smith's Wealth of Nations, in 1776, nothing appears to have been done worth detailed notice in addition to the labours of the Economists.

The next step in the advancement of this science, was the Essay on the principle of Population of Mr. Malthus. The intent of this Essay was to show that population de-

pends on subsistence; men and women cannot be raised unless they have food to eat. 2. That plenty of food increases population, by enabling marriages to take place, and children to be raised. All this had been observed before by M. Herbert n his Essai sur la Police des Grains, 1755; by Mr. Wallace in his treatise on the numbers of mankind; by Dr. Darwin in his Botanick Garden; and by Mr. Townsend in his Dissertation on the Poor Laws, 1786.

The works of M. Storch, of Petersburgh; of M. Ganilh; of M. Sismondi; but above all of M. Say, have contributed to throw light on this science, among the Sçavans of the continent.

In Great Britain, during this period, the most important work published, was "The Principles of Political Economy and Taxation," by Mr. Ricardo, 1817.

The positions thus laid down by Mr. Ricardo, have been followed by Messrs. M'Cullock and Mill; and constitute the difference between the old school of Dr. Adam Smith, and the new school, of which these writers seem to be at the head.

Political Economy then treats of the sources, the production, the distribution, the accumulation, and the consumption of national wealth: the effect of those institutions on society which are immediately connected with the increase or diminution of national wealth: and the effects produced on society itself by its increase or diminution. The end and object of this branch of knowledge, is to show in what manner, and by what means, the physical gratification of human wants can be most equitably, conveniently, certainly, and effectually distributed among all the classes of society.

Wealth is a plentiful possession of those material objects on which exchangeable value has been conferred by human skill and labour—which are desired for the gratification of human wants—and which cannot be obtained by those who seek them, but by giving some other object in return, equally desirable to him who receives it. The wealth of an individual, or a nation, consists in the abundance and cheapness of those articles which are useful or desirable for the gratification of human wants. Hence wealth may increase where price diminishes. I can afford to lay out five dollars in silk stockings at the present price: let the price or exchangeable value be reduced one half: then one half of five dollars will answer to me an equal purpose.

Riches is a word synonymous with wealth. The last expression (wealth) being gradually adopted by writers on political economy in our own language, I have used it also. The French use the word Richesse; meaning, as we do, plenty of whatever is desirable to man on account of its yielding pleasure, or contributing to our comforts, or necessities.

Sources of Wealth.—Labour employed in conferring on a raw material some property or quality that renders it desirable. Skill and capital are usually necessary for this purpose; but these, by ultimate analysis, are resolvable into labour.

Labour.—Human exertion employed to produce or confer some desirable quality or property (that is, exchangeable value,) on some raw material. Hence labour is the main or rather the only source of wealth. Labour is, for the most part, hired and exerted for the sake of the wages or remuneration paid by the employer. When we speak of labour, we usually refer to the mere bodily exertion of a day-labourer, exclusive of acquired skill. Political Economy itself may be considered as that science which determines the circumstances that influence the productive power of human labour, and the distribution of the proceeds.

Wages.—That portion of the money-value of the commodity produced, which the labourer receives as his compensation: in other words, the money or other useful commodity given as a compensation to the labourer for his labour. This must be so much as to ensure to the labourer and a moderate family, a portion of the necessaries of life, sufficient to sustain bodily strength. Hence, all taxes on the necessaries of life either enhance wages, or reduce the labourer to want. Wages are higher when combined with skill, which is acquired by previous labour and may

in fact be considered as capital. Thus the wages of a painter or sculptor are far greater than those of the weaver of the canvass, or the digger in the quarry.

Value.—Utility, real or fancied, conferred by skill, labour, and capital. Thus, a piece of glass made into spectacles, has real utility conferred on it; a piece of glass cut in imitation of a diamond, has fancied utility conferred upon it. In both cases exchangeable value—that is; some desirable quality has been artificially conferred on the rough and worthless material.

Productive Labour or Industry.—That which confers exchangeable value on any material object, which it did not possess before; or which confers skill and knowledge, which can be used in conferring value; or which are in themselves valuable and saleable, as the knowledge of a lawyer or an engineer.

Unproductive Labour or Industry.—That which is expended without producing value, or contributing to produce it.

Production.—The formation of any thing desirable, or that constitutes wealth. It is the result of labour.

Produce.—The effect of productive industry employed upon the soil or land.

Product.—The effect of productive industry employed in rendering any material substance valuable. Nearly synonymous with the popular word "Commodity." A product generally depends on the productive agency of nature, of skill, labour, and capital. It is for the most part the combined result of these. Thus, in a steam-engine, the skill, labour, and capital are employed to render the natural agents fire and water productive.

Land.—Includes soil, waters, fisheries, vegetables, rocks, mines, and minerals. Land supplies raw material and food.

Productive Agency of Nature, then, is the useful effect of natural agents, whether guided or not by human industry: as the Sun, the Rain, the Soil, in Agriculture; as Wind in a Windmill, in a Ship, in a winnowing machine; Water in a dam; Heat in a furnace, steam, &c.

Ingredients of Value.—Cost of the raw material, which is sometimes paid in the form of rent: as for brick-earth near a metropolis like London; for land containing porcelain clay: for a marble quarry; for ozier swamps on river banks, to make baskets; for a quarry of burr-stone, for a mine, &c. The intrinsick value of raw material before any labour is bestowed upon it, depends on its plenty or scarcity, or the difficulty or facility with which it can be procured, and its capability of receiving value by means of skill, labour, and capital employed upon it. A handful of mud is of no value; a handful of raw diamonds may be of great value. The next ingredient of value, is wages of the labourer (that is labour) employed in producing and conferring value on this raw material; then the profits of the capital necessarily expended in purchasing the raw material, paying the wages, furnishing the tools and implements, &c. This also is reducible to labour.

Measure of Value.—The actual practical measure of value, is, the average money-price of the article in question, at the given time and place; and it is the average, because the money-market, or current price, will be sometimes a little higher, sometimes a little lower than the natural price, owing to temporary fluctuations in demand and supply. It is reducible to the quantity of labour the article can command. Money is the representative ultimately of labour.

Price.—The amount of other products which any useful article will command in exchange. This is exchangeable value. The elements of price may be considered as being wages and profits; whether rent or the cost of raw material ever enters into the calculation of price is doubted by some. In agricultural produce it certainly does not. In some cases, where the raw material is scarce and dear, I think it does.

Money Price, Market Price, Current Price.—The amount in current money which any useful or desirable article will command when exposed to sale. This depends permanently on the natural price, and

occasionally on the demand compared with the supply. Market price is the price for the time being.

Real Price, Natural Price, consists in the cost (if any) of the raw material, the amount paid in wages for the labour expended upon the article, and the usual profit on the capital employed upon it; all reducible to the labour expended upon it before it be fit for market. It is that price which will enable the seller to reproduce the article in the same market, with a reasonable profit. If this cannot be obtained, supply ceases. Prime cost will be this natural price, deducting the profit on the capital employed.

Social Price.—The price that commodities bring when influenced by restrictions, monopolies, taxes, and legislative regulations. Thus, the natural price of a bushel of wheat or the amount of labour necessary to grow it and bring it to market, is one thing; the price of the same wheat influenced by the corn laws of Great Britain, is one half more. This last is the social price.

Glut.—Over production: so that the market price falls below the natural price. A glut may be of a single commodity, or of a great number. It may be of longer or shorter continuance. In England, for some years, it has been so extensive and continued, as to be almost general, owing probably to the immensely productive power of machinery, and the unequal distribution of wealth.

Raw Material.—Any material object employed to receive value, or to have utility conferred upon it by human industry, skill and capital. It has, therefore, a natural value dependant on its capability of receiving artificial value.

Commodities.—All articles possessing exchangeable value, and commanding price.

Exchangeable Value.—That property conferred on any raw material, by means of human skill, labour, and capital employed upon it, that makes it so desirable as to induce other persons to give for it some other valuable article or commodity in exchange. Human skill and labour therefore are productively expended, not in producing the commodity or article itself, but the useful or fashionable property which makes it desirable and sought for by others—producing and conferring that value which causes the commodity to be in demand. Useful articles that nature has provided in abundance, such as air, water, fire, light, have no exchangeable value in their natural state; any person may without price obtain as much of them as he need. The exchangeable value of an article increases with the quantity of skill, labour, and capital necessarily employed in producing it. This value then consists in the power of purchasing other goods, conferred by its possession.

Revenue, Income.—The annual amount of money or other valuable commodities which a man is entitled to, or receives, whether as landholder in the form of rent—as agriculturist, manufacturer, or merchant in the form of profit—as a member of one of the learned professions in the form of fees—or as a magistrate or publick officer in the form of salary—or in any other lawful way.

Expenditure.—That portion of a man's revenue which he lays out or expends for the gratification of his immediate wants: and which being consumed, produces no further profit or advantage than the gratification of his wants. This expenditure may be prudent or necessary, according to his situation in life; but he is nevertheless poorer in proportion.

Consumption.—Produce may be eaten up, worn out, destroyed, consumed, for the personal gratification of the possessor, without view to future profit. In this sense it is synonymous with expenditure as above explained: and is unproductive; as the wines on a rich man's table.

But it may be eaten up, worn out, destroyed, consumed, for the purpose of maintaining labourers, buildings, tools, machinery, &c. with a view to future profit: this is productive consumption. Productively or unproductively, whatever is produced is consumed on an average, in about a year. Governments are great consumers, and usually with enormous waste.

Capital.—That portion of a man's revenue which remains as a surplus or saving after all his expenditures are made. A surplus which may be laid out to produce further profit or additional revenue.

Circulating Capital.—A popular phrase in use to express that mass of revenue, whether belonging to individuals or to the government of a nation, which is laid out and expended in commodities wanted, whether for immediate consumption or future profit; whether destroyed and consumed in the form of present expenditure, or destined to form a part of accumulated capital, as the basis and source of future additional income. Circulating capital must not be confounded with circulating medium, which last consists of the gold and silver coin, and paper money of a country; and serves no other purpose than to facilitate, by means of a common standard of reference, the interchanges and barterings of the circulating capital, which is of far greater moment and amount.

Wealth is a relative term, for as there is only a certain amount of property in a country, so the possession of a large share by one man is the poverty of others. The wealth of individuals is therefore no benefit to the country, while as to others it is the cause of their poverty. If all the property in a country is worth a million, and one man has half a million, there remains but half a million for all others, and if nine or ten possess nine-tenths the rest would be poor. This principle of accumulation, the curse of advancing, or old, society, is favoured by the substitution of money for barter; since goods could not be accumulated like money, and money is therefore properly denounced as the root of all evil, and it is declared that no rich man can enter the kingdom of heaven. To correct these mischiefs, the inducements to accumulate should be diminished by fixing a very low rate of interest for money in comparison with the wages of labour or the profits of industry. Money, as an artificial convenience, ought not to be allowed to be abstracted, and usurers should be systematically discouraged, for the general benefit of the whole community. Interest of money is the slavery of the borrower to the lender, and there ought to be as few slaves as possible, while the slavery which exists ought to be of the slightest kind.

Fixed Capital consists of the workshops, warehouses, buildings, tools, and other conveniences necessary to produce future profit by means of the capital thus invested in them. These, in mercantile and manufacturing language, constitute the plant of a merchant or manufacturer. The stables, the barn, the granary, the sheds, the carts, the wagons, ploughs, harrows, and other implements of husbandry, the horses, cattle, &c. of a farmer constitute his plant or fixed capital. Plant is a metaphorical term, as if a man were planted and rooted where his fortune is to be made and grow.

Stock, produce of accumulated labour, kept for the purpose of being employed with a view to further profit.

Profit is not the excess which a man receives for any saleable commodity beyond the real or natural price which includes profit, but the return in value which he receives for laying out and managing or superintending his capital. When a man brings to market an article possessing exchangeable value, it has already cost him the price of the raw material, the amount of wages employed upon it (greater in proportion to the skill required) and the legal interest of the capital employed upon it. This is the prime cost. To this he adds the usual profit upon his capital. The usual rate of profit in a country regulates the profit in particular cases. This usual rate of profit is principally regulated by the profit of agriculture, the earliest and most common of all employments, but attended with the minimum of profit.

Rent is the price paid to a landowner, for the loan of capital in the form of land, of houses, warehouses, water-power, machinery, &c. Clear rent is that which remains to him, after deducting interest of capital, expenses, and all out-goings. Rent is lower than profit; because the receiver of rent is put to no trouble, is called upon for no skill, and incurs

no risk. At least, this the case where rent is paid in money. Those who embark capital, as agriculturists, merchants, or manufacturers, must employ their capital, under the direction of technical skill, previously and laboriously acquired; and they generally incur some risk of losing their profit, either from want of demand for the article, or insolvency in some of the purchasers.

Interest is the rent or compensation paid for the use of capital, generally of capital in the form of money loaned to some person, who, by the addition of technical skill, wishes to make profit of the capital loaned. As interest, like rent, is received without any trouble or risk incurred by the lender, it is always much less than profit. Generally, the average profit or capital in any country is three times the amount of the usual rate of interest, where business is transacted by wholesale.

Productive Expenditure.—Capital saved out of revenue, and employed with a view of profit.

Unproductive Expenditure.—That which is expended on articles that are consumed without any view to profit in consuming them: as in food, clothes, wine, amusements, &c It does not however follow, because expenditure takes place without any thing of value remaining, that it is useless. Useful expenditure is one thing, productive expenditure is another. It may be useful as the nourishment necessary to life. Still, not being so applied as to produce future profit, it is properly termed unproductive.

Unproductive Class.—Those members of society who do not labour in any manner, or whose labour may well be dispensed with, as contributing little or nothing to the gratification of those human wants in which it is innocent and desirable to indulge.

Money.—Some article or commodity, real or imaginary, employed to supersede the necessity of bartering or exchanging for each other, the innumerable variety of commodities that are demanded and supplied. So that every article may be valued in reference to some common standard of exchange, some common measure of value, which should, if possible, be devoid of value itself, except for this use to which it is applied. In some parts of Africa, the money consists of the shells called *cowries;* in other parts, of bars of iron. Most civilized countries have adopted the precious metals (gold and silver) as having an intrinsick value which fluctuates very little; for a common measure to be perfect, should be either of no value or of a value not subject to change. No known material possesses all the necessary qualities; the precious metals approach only to what we want.

Money, therefore, (whether coined money or paper money) has or should have no value itself: it is the unit or standard to which values are referred. It is the representative and exponent of wealth; it does not constitute wealth. A certain quantity in every country is necessary in proportion to the business carried on, to serve as a circulating medium, by means of which exchanges are calculated and facilitated. But beyond this employment of money its accumulation is useless; or rather detrimental. For if it be more abundant than the demands of commerce for circulating medium require, the money price of every article rises in proportion, foreign commerce is impeded, and the coin is sent off to countries where it bears a higher price. Money coined out of gold and silver has, within 25 or 30 years, been gradually superseded in great part by paper money; whether advantageously or not, all circumstances considered, is a question of doubt and limitation.

Bullion (gold and silver uncoined.)—These, when manufactured, have value as articles of commerce; for convenience and ornament independent of their use in coin. This value, as a useful and ornamental material, frequently occasions the market value of bullion to fluctuate; and operates as a considerable disadvantage in the use of these metals for coin. In the early stages of society, gold and silver being frequently found in a metallick form, were in greater plenty than iron and other metals, which required to be extracted by a long and difficult process from the ore. We see this in

Homer's Iliad. The value of gold and silver, depending on their scarcity, and on the amount of labour necessarily expended in procuring them, fell greatly soon after the discovery and intercourse with Spanish America.

Circulating Medium.—Any kind of money, any common standard of measure or value, whether of metallick coin or paper, that passes currently in payment for commodities that are in demand. Currency is the same with circulating medium.

Bank.—The circulating medium, currency, or coin of Europe, until about the middle of the last century, consisted chiefly of coin manufactured out of bullion: every country having its own coin, that served as a measure of value for all its domestick transactions, but was seldom employed out of the country. Abroad, coin passed, as it now does, only as bullion of a given weight and fineness; and therefore a loss was often suffered on remitting it to foreign parts, beside the risk and expense of transmission. Hence arose the substitution of bills of exchange.

Paper Money: paper currency.—This is usually considered as consisting of banker's promissory notes, payable on demand. But these by no means constitute the whole of paper money, or even the most considerable part of it. The other kinds of paper money in common use, are bank credits and bills of exchange, domestick and foreign, and merchants' drafts on each other. The merchant who draws this bill of exchange in consequence of having transmitted goods to the amount, either sells this bill to his neighbour, who has imported goods from the same country, or else he receives from his foreign debtor a bill of exchange in return, on some person in the country of the creditor, or within the circle of his dealings. The price of bills of exchange on a foreign country will depend, like every other commodity, on the demand and supply, and this will depend on the balance of trade between the two countries. If France sells to England to the amount of a million, and has bought from England to the amount of half a million, bills upon England will be plentiful and cheap in France, and bills on France will be comparatively scarce and dear in England. Exchange is limited by the trouble, expense, and risk of transmitting coin, for which it is a substitute. When the exchange demanded is higher than the risk and expense, the merchant refuses to buy a bill, but sends off his coin to pay the balance against him. Bills of exchange therefore are no more than contrivances to save the expense and risk of transmitting coin, and also to save the interest that coin will yield if employed at home during the interval of transmission.

Commerce is the sale and purchase, and general interchange of valuable commodities, by which the wants of men in society are supplied. It is divided into the home trade, the foreign trade, and the carrying trade. Commerce is popularly applied to the foreign trade. The object of commerce is the supply to one country of the productions of another; but avarice or profit leads to speculations and competitions which swell commerce to an unnatural extent, cause supply to precede demand, and create more miseries than any other evils with which mankind were ever afflicted.

Home Trade.—That sale and interchange of commodities which is carried on at home within a nation, and where the inhabitants of that nation are the sole customers and purchasers. The amount of the home trade, even in Great Britain, is about ten times the amount of the foreign trade. In every other country, from ten to twelve times. At home, each man spends about three-fourths of his income among his fellow-citizens. Foreigners purchase only what they are strongly tempted to buy.

Foreign Trade.—That commerce which is carried on between foreign nations. A merchant is employed in bringing valuable articles from a distant country where they are cheap, to another country where they are scarce and dear. A considerable benefit of foreign trade is the mutual communication of improvements in all things relating to the comfort of human existence.

Carrying Trade, consists in the carrying of exportable commodities from one nation to another, the gain consisting in the freight thus earned. This trade flourishes among neutrals when other nations are belligerents. Sometimes the neutral purchases the commodities of one belligerent and sells them to another.

The Balance of Trade has long been a bugbear with half-informed people, who look no further than custom-house entries; but, on a great scale, it is in fact in favour of every nation upon earth, or commerce neither would nor could be carried on.

Luxuries.—Any commodity purchased not necessary or expedient, according to the rank and fortune of the purchaser, and that occasions a disproportionate expenditure of income.

Stocks—Publick Funds—National Debt.—When the taxes are inadequate to the exigencies of the state, government draws upon posterity; borrowing from individuals, and paying them such interest as is agreed upon for the capital so loaned. This capital does not any more exist. It has been spent, merged, dissipated. The debt remains. The stipulated interest with which the community is burdened, is made transferable and assignable. The stocks, funds, national debt, are words designating this interest, which has become annually payable to individuals, for the capital formerly loaned by themselves or those they represent. The individuals who pay the taxes, destined to discharge this annual interest, are burdened in proportion to the amount assessed upon them; and, as all who possess property raise its price in proportion to the burden on them, so all taxes fall on labour, which, as the last term, cannot shift on any other class.

Population—Healthy Population.—By this last term is meant, that number of people in a community which is sufficient to supply the demand of labour, but barely so. The great mass of the people live more fully, more happily, where there is a constant demand for labour, than where that demand is insufficient to employ those who have nothing but labour to subsist upon. Every man who places himself in the market as a labourer to be hired, comes in competition with every other man in the same situation; and this competition has a tendency to lower wages, and of course to detract from the comforts, and encroach upon the necessaries of life.

Government is a term usually employed to designate and comprise the persons who control the legislation and constitute the executive power of a nation. In almost every country, what is called the Government is the most wantonly, extravagant and ill-managed establishment that the people have to support. This arises from mistakes in the political structure of the government. Mistakes, consisting in unnecessary officers of government, paid by extravagant and unnecessary salaries; in too much power conceded; or conceded for too long a period; and in the want of means to enforce sufficient responsibility on the part of those who govern. The system of government should be as plain to be understood, and as simple in its construction as possible. The agents and officers of government gain by mystery and complication. —*Professor Cooper.*

A SKETCH OF JEWISH HISTORY.

Some of the Facts, as they appeared in the English edition of this work, the publishers, with the editor, felt no disposition to promulgate, many of them being of a local nature, and others of questionable utility. To supply the place of those omitted, the following brief sketches are substituted, believing that they will be more acceptable to the reader than those stricken out. Those appended are, a brief sketch of Jewish history, one of American history, an account of the rise and progress of the useful arts in this country, and, also, brief notices of the literature of the same. The reader will readily see, that the matter thus added has been thrown into paragraphs, in order to conform, as far as practicable, to the general style of the work.

American Editor.

As a piece of composition, the cosmogony of the Jews transcends all other in the world. It is brief, sublime, and holy; full of Omnipotence, Omniscience, and boundless love. All things sprang from the Godhead, without any thing that seemed like human effort, as in other cosmogonies. One part of creation arose after another, as rapidly as the human mind can comprehend it in description, and as beautiful and lovely as the imagination can conceive of it. Other creations arose, as the sport of heathen gods; but this in the Beginning was made for man; and the dominion over the beasts of the field, and the fowls of the air, was given to him, and the *greater and the lesser lights* were made for his use. "God said, let there be light in the Heavens, to divide the day from the night, and let them be for signs and for seasons, and for days and years."—And certainly these signs and seasons, days and years, were for man;—not for Himself, for to Him there is neither beginning of days nor end of years.

The disobedience of man, the loss of Paradise, the promise to him and to his seed, all follow in so direct a chain, and, if the expression may be allowed, so naturally, that we should rather pity the man, for want of taste and understanding, than quarrel with him, who wishes to substitute any thing else for this beautiful proema of the Jewish Scriptures.

The 1656 years from the creation to the flood, from the length of human life, swept off but few generations; and the father of Noah, the connecting link between the two worlds, the line before and the other after the flood, must have been in intimacy with the father of mankind.

From the flood to the call of Abraham, 427 years after the flood, the nations of the earth must have considerably increased, and were probably enlightened; for much of the knowledge of the antediluvian world was saved, it is supposed, by Noah and his sons. From the adventures of Abraham, we learn that the people around him were governed by kings, who were frequently at war. The knowledge of the true God, however, had been preserved by some nations, as well as lost by others. The language of mankind had previously been confounded, and they were no longer of "*one lip and one voice.*" Those acquainted with the science of etymology, find, in every day's advancement in knowledge, proofs of this fact, that all languages had one common origin.

The next epoch was the institution of the Passover—established to keep in remembrance the deliverance of the Jews from the *land of Egypt and the house of bondage.* This was 430 years from the vocation of Abraham. This comprised a most eventful period to the nation.—Isaac, and Jacob, and Esau, had lived, and the

sons of Jacob, in primitive simplicity; and the latter had gone down to Egypt, with their aged father, to better their fortunes, on the elevation of Joseph, the son of Jacob, and had passed from a favoured people to slaves. They had broken their way from Egypt, and ventured to seek a land of freedom, and one they could call their own; and this was done by the sword. This was 857 years from the flood; and the earth, at least some parts of it, had become thickly settled. The Asias were populous; and probably a good part of Europe was then peopled.

From the institution of the Passover, to Saul's accession to the throne of Israel, embraces a period of 396 years. This was passed in making and securing conquests; sometimes hard pushed by their enemies, beaten, and oppressed; and sometimes reacting with a vengeance that made their enemies beware of them.

From Saul's accession to the throne, to the close of the life of Solomon, was the *high and palmy state* of Hebrew glory. It was the lot of David to make his empire a military one—it was decidedly so. He was a man of war, and was surrounded by the most valiant band of heroes that any monarch ever had. His, too, was an age of literature. He surpassed all others of his nation as a poet and a scholar, and gave a mental tone to his people which they had never known before, although Samuel had opened the way for him by founding a school of the prophets. He elevated their poetical taste, and gave to the harp new strings, and to the choir new members. Jerusalem grew in his reign, and the twelve tribes of Israel assumed a high rank among the nations of the earth, as well for knowledge, as military prowess. The reign of his son Solomon was still more prosperous and glorious. David had weakened and subdued his foes; and Solomon had peace in his time. The riches of the world poured in upon him, and he displayed his grandeur with Oriental magnificence. He was wiser than all who went before him—"And Solomon's wisdom excelled the wisdom of all the children of the east country, and all the wisdom of Egypt. For he was wiser than all men; than Etan the Ezrahite, and Heman, and Chalcol, and Darda, the sons of Mahol; and his fame was in all nations round about. And he spake three thousand proverbs; and his songs were a thousand and five. And he spake of trees, from the cedar tree that is in Lebanon, even unto the hyssop that springeth out of the wall: he spake also of beasts, and of fowl, and of creeping things, and of fishes. And there came of all people to hear the wisdom of Solomon, from all the kings of the earth, which had heard of his wisdom." If Solomon had not more genius, he had more learning than his father, having had better opportunities in getting knowledge, as the son of a king, from the philosophers of other countries, than his father, the minstrel shepherd of Israel, could have had. If there was not so much knowledge and system in his father's compositions, there was a deeper devotion, and a sublimer imagination. Under such kings, the people must have been devoted to learning, for people imitate their rulers in every thing, and no little minds can find favour in the eyes of the great, when they themselves are enlightened. If the mighty mind of Bacon could be so far affected by fashion, as to imitate the quaint and pedantick style of King James, how anxious must those have been, whose common salutation was, "*O king, live for ever*," to imitate such splendid and royal examples as those of David and Solomon.

In the next reign, this people were divided among themselves, and never after stood so high among nations as before: After years of civil wars, of wickedness, and repentance—of success and misfortune—they were broken down and carried into captivity. In process of time they were permitted to return, and rebuild their temple, which had been destroyed. This period, from the accession of their first King, Saul, until their return to Jerusalem, comprises, according to chronologists, 559 years.

On their return to Jerusalem, the pontifical power was put over the kingly, and in this way they were generally governed for 536 years, to the coming of Christ;—sometimes, however, a neighbouring king claimed supremacy over them, and sometimes a Roman proconsul was sent

to collect the tribute imposed on them. Soon after the advent of Jesus Christ, the city of Jerusalem was destroyed, and the Jews scattered over the world.

There is no history so full of instruction as this. Its chronology is better than that of profane histories. It is written, not to extol any person, or blazon the deeds of any one; but seems an honest, straight-forward chronicle of events, naming the persons who were agents, and the events brought about. The characters of individuals are models for all times; there is no flattery about them; the faults of each individual are named, as well as their virtues. Every thing relating to the patriarchs is distinct and natural. How different is Isaac from his father Abraham: the former was a man of energy, faith, and determination; there was nothing feeble or ordinary about him;—but Isaac seemed formed only to continue the race of Abraham, for there is not one act of his life that could give him any distinction, except that he went out into the field to meditate; but in his sons, Esau and Jacob, there were strong characteristicks; and Jacob, in his dying blessing, as it is called, displayed the individual characters of his own children in a bold and striking manner.

The characters of Moses and Aaron are given us in a few words: Moses was meek and modest, and said that he *was not eloquent, but was slow of speech, and of a slow tongue;* but Aaron, it was said, could speak well; the one consulted, and advised in secret; the other was spokesman to the people: but in often time, Moses was not so guarded but that in his anger he committed himself, although he was instead of God to his brother Aaron; nor was the high priest, whose eloquence could sway the people, proof against their complaints. In both, the superhuman gifts were mingled with human feelings, for lessons of instruction to all. This principle of giving the virtues and the failings of distinguished men, was never lost sight of in the Jewish history. The marvellous strength of Sampson was wasted in wild frolicks of daring—and his mightiest feats had a ludicrous air about them; even his death would probably have been disgraceful, if the spirit within him had not stirred him to make a sacrifice of Israel's enemies, to avenge himself of his wrongs. He was given for an example, that strength may be overcome by weakness, and wisdom by folly. The character of the prophet Samuel is traced from his birth to his death with astonishing minuteness in a few short chapters. The first moments of his early visions are recounted, and also his last acts; and the whole history of the Jews during this period is admirably carried on with the biography of this judge in Israel. The lives of King Saul and his son are only secondary to it, and seem intended merely for contrast and illustration.

The history of the age was not only in the biography of their leaders, but in their poetry also. An ode or poem was made to commemorate every great occasion, and sung by all who could sing a stave; and repeated on every anniversary of the great event it was intended to celebrate. On the passage of the red sea, Moses wrote a poem, and sang it himself; while his sister Miriam, a prophetess in Israel, sang the chorus. This song was an entire history of the event, and was also an imperishable monument raised to perpetuate the gratitude of the nation. The song of Deborah, in which her chief general joined, was so descriptive of the misfortunes of the country before she *arose a mother in Israel*, that no portion of the common narrative can be compared with it: she calls on kings and princes to hear; she says that *the high* ways *were unoccupied*, and the traveller *walked through byways;* she describes the deserted villages by reason of the desolating wars, and the infidelity which reigned in this state of national calamity; she enumerates the tribes who acted bravely in the war with Sisera, who came down with force and might against him; and rising into poetical splendour, she says, *They fought from heaven; the stars in their courses fought Sisera. The river of Kishon swept them away, that ancient river, the river Kishon: O my soul, thou hast trodden down strength.*

The denunciations against those who absented themselves that day were deep and bitter, but full of

patriotiek justiee. "*Curse ye Meroz, said the angel of the Lord, curse ye bitterly the inhabitants thereof; because they came not to the help of the Lord,—to the help of the Lord against the mighty.*"

David's lamentation over Saul and Jonathan was a beautiful elegy, made to eommemorate their virtues;—it was taught to the daughters of Judah, who were the musicians and the prophetesses of the day. The great psalmist knew that sueh an epitaph would last longer and be better known to mankind in future times, thus written on the memories of suecessive generations, than if he had reared pyramids to their fame, and covered them with a thousand inscriptions.

The book of Job, as it is ealled, is one of the finest dramas ever written, whoever might have been the author. The plot is more natural than most of those of the Greek tragedians, and is full of better morals and a higher philosophy, dictated by a more elevated muse. The Idumean bard was initiated into all the wisdom of the most enlightened nations; he was a naturalist and an astronomer, as well as a poet, and added to his knowledge of seienee and literature, and to the most admirable genius for poetry, an aequaintance with the true God, whose government is as benevolent as just. The answers of the hero of the drama are as pious as wise; and, with the familiarity of primitive times, contain the riehness of Eastern magnifieenee.

The profound seholars in Hebrew literature inform us, that there is as mueh difference in the language in whieh this work is written, and that of the eommon Jewish chronicles, as there is between that of the old English historians and ballad makers, and the divine sweetness and lofty composure of the verse of *Paradise Lost*. If this be not true to the full extent of the assertion, it is so in a eonsiderable measure; and this truth is, in no slight degree, visible even in the translation whieh is now in common use. Several Oriental seholars, not entirely satisfied with the present translation, have given us others, abounding in new beauties, and developing new points; with notes, containing some delicious morsels of criticism.

The prophets, whose works have come down to us, lived in the most troublesome times of Israel; some few of them before, but most of them about the time that the Jews were in diffieulty, after the dismemberment of the tribes, and while the consequent eivil wars were desolating the eountry. The slaughtered hosts of their own eountrymen, gave to the thinking, feeling, and pious part of the community, a deep tone of grief and anguish; and it is every where found in their writings. Isaiah added to his denuneiations and forebodings, the mightiest promises that were ever given to man. The whole is elothed in epick dignity, and every word eomes to us as from one speaking the oracles of God. He is sometimes mystieal, from the intensity of his feeling, and his numerous flights of imagination. He taught the heinousness of sin, the impudenee of sinful man, the oppression and the eovetousness of rulers, and the eertainty of fast-eoming evils to his eountry. His visions are full of the glory of inspiration; and his seraphims burn with a hallowed fire, surpassing those of other prophets.—He prophesies the eoming of the Messiah and his peaeeable kingdom, in words that breathe the airs of Heaven; the fate of Babylon is predieted with almost historieal minuteness; the downfall of the great city is proelaimed; the mother of harlots is to sink; and the wretehed remnant of his eountrymen are to be restored. The whole of the book is terrifieally beautiful, and awfully true, in sentiment as well as in propheey.

Jeremiah is full of tenderness, of delieacy, and feverish distress for the people of his country. He lived in evil times, and his soul was alive to every thing of history or of propheey. It is worthy the most profound attention, for its deep feeling and poetieal eleganee.

Daniel makes a most distinguished figure in Babylon, with Nebuchadnezzar, and with his grandson, Belshazzar, as he was finishing his wicked course. With Darius he was also a favourite—and made an indelible impression on all the inhabitants of Babylon. His whole soul was wrapped up in the fate of his people, and it gathered all his na-

tive and acquired strength, to serve them with all the forecast of his hallowed calling. The rest of the prophets, as they have reached us, are probably only fragments of larger works; but as the scriptures are, they are invaluable, and we should read them day and night, for information and edification. The reader may rise from the Jewish scriptures, often indeed shocked by the wickedness of man, and with tears for the miseries of individuals and nations; but he sees a mighty and eternal mind presiding over all things, educing good from evil; a power that turns and overturns, until all things come right, and the iron rod of the oppressor is broken, and the meek and lowly are raised in strength, and received into favour. New lights are rushing in upon the human mind in this our day, as it regards this volume;—much of the dark has been illumined; much of the mysterious explained, and many apparent difficulties cleared up, by the great vigour with which the divines of our time have pursued Biblical criticism.

SKETCH OF AMERICAN HISTORY.

Among the extraordinary events recorded in modern history, the discovery of this Western Continent stands pre-eminent. To Christopher Columbus belongs this distinguished honour.—On Friday the 4th of August, 1492, he sailed from Palos, in Spain, with three small vessels, having ninety men, who were furnished with provision for one year. He, as Admiral, commanded the Santa Martha, the largest ship, Martin Alonzo Pinzon was captain of the second, and Vincent Yanez Pinzon, of the third. When about 200 leagues to the west of the Canaries, Columbus discovered the magnetick needle did not point exactly to the north, but varied to the west. This extraordinary phenomenon excited great alarm among his men; but Columbus, with wonderful sagacity and address, was enabled to allay their fears. On the night of the 11th of October, land was discovered, which proved to be an island, now called St. Salvador, one of the West Indies.—On the 12th, Columbus landed in the new world. The natives were filled with astonishment, considering the Spaniards to be superiour beings. On this voyage, he discovered several islands, among which was Cuba. This great navigator made three other voyages, in the last of which he discovered the continent at the mouth of the river Orinoco. The latter days of this great man were imbittered by the ingratitude of his king, and the persecutions of his enemies. He died, broken-hearted, at Valadolid, in Spain, on the 20th of May, 1506, in the 59th year of his age.

Two Venetians, John Cabot, and his son Sebastian, in the service of Henry VII. of England, were commissioned by this monarch to undertake an exploring voyage to the new world. On the 22d June, 1497, they discovered Newfoundland; from thence they coasted along the continent as far as the Floridas.

Among the first adventurers was Amerigo Vespucci, a Florentine, who in 1499 accompanied Ojeda, an enterprising and skilful navigator, on his voyage of discovery. On his return, Amerigo published an account of his voyage in Latin. This circulated rapidly, and was distributed throughout all Europe. Columbus had not then published any particulars of his adventures. Owing to this circumstance, and to some unaccountable caprice, this continent has ever since been unjustly called America, instead of Columbia. The history of the settlement of South America is nothing but a tissue of bold enterprise and of crime.

This discovery ruined Spain and Portugal, and the rapidity of their downfall was in proportion to the influx of wealth from the mines in their provinces. The most distinguished adventurers to South America were Cortes and Pizarro. Their exploits were those of reality, but in appearance those of fiction and romance. Juan Ponce d'Leon sailed in search of the fountain of immortal youth, but found a premature grave. True immortality is only found by pursuing the path of virtue and wisdom.

But we will leave South America, with all her wonders and all her crime, to proceed to North America, a land of glorious growth, in which

all the great doctrines of rational freedom have been developed. The history of South America remains to be written out; and perhaps it were better that a part of it should never be fully understood. What were once colonies of Spain are now nominal Republicks, and have set up a claim to be numbered with the republican family.

In 1578, Queen Elizabeth granted letters patent to Sir Humphrey Gilbert, giving him great power and immunities, in an exploring expedition. Among other privileges, he was authorized to take possession of all barbarous lands unoccupied by any christian people. He was an unfortunate navigator, yet a bold, persevering, and excellent man. He took possession of Newfoundland, one of the most dreary and inhospitable spots yet discovered, and that at a time when he had half a continent to choose from. In 1584, Sir Walter Raleigh laid a plan before Queen Elizabeth, for settling some portion of the territory claimed by England, on account of the discoveries of the Cabots; the Queen approved of his project, and Raleigh sent out two experienced navigators, who, on their return, gave a favourable account of the country. The next year he made farther efforts, with extensive means, to form a settlement on the southern part of what is now considered as the old United States, but disaster after disaster destroyed his plans, and baffled all his calculations. During this period, Ralcigh was making the most strenuous exertions in colonizing America, and several bold navigators were his coadjutors in this good cause. Thomas Cavendish, who had circumnavigated the globe, was now sailing along the coast of South America. Sir Richard Grenville conducted an expedition to Virginia. He was a gallant commander, and fell, mortally wounded, in a fight with the Spaniards. Christopher Newport, George Drake, Henry May, George Weymouth, and others, were out upon expeditions to harass Spain, and to establish colonies, or to protect those already established.

Bartholomew Gosnold, in 1602, was the first who came directly across the ocean, instead of going to the West Indies. He touched the continent in North latitude 42, and taking plenty of cod-fish, named the place Cape Cod, or, as some say, from finding the cape in shape like the tail of that fish. There is a small island, not far from the cape, called Gosnold's Island, which bears marks of some civilization. In 1603, Richard Hakluyt followed Gosnold, and coasted from Penobscot to Massachusetts Bay.

The French now recovering from their civil war, sent out explorers all along the coast. The English had hitherto failed in every attempt to plant colonies on these shores. Many noble efforts were made, but all to no purpose. More than a century had elapsed since Cabot's discovery of the northern part of the continent; voyage after voyage had been performed by highly sagacious navigators; but many, inclined to the belief of predestination, would have said, it is evidently the will of heaven, that the wilderness shall never blossom as the rose, nor shall civilization spread in the new world; yet it was otherwise decreed.

In 1606, there was not a log hut in all North America, inhabited by a white man, notwithstanding all the exertions that had been made for colonizing the country. The spirit of the adventurers was, however, neither broken nor subdued; and hundreds who once thought lightly of the plan of sending forth colonists, now heartily approved of the measure. A greater diffusion of knowledge expanded the views of European politicians, and the commonalty began to think that men might live and flourish in other than European climes; but had the adventurers foreseen all they had to encounter, the wilds would have remained, for ages to come, the hunting grounds of the savages, and the streams would have rolled on unbroken by mill or dam to the ocean.

In 1607, a patent was given by King James to certain persons, and a hundred of them embarked for Virginia. They intended to land at Roanoke, but were driven by a storm to the northward of that place. On the 13th of May, they took possession of the spot in Virginia, now called Jamestown. They began in aristocracy, and of course went on in confusion. John Smith was the soul

of the whole, and without him, they would all have perished. His adventures have produced volumes, as wonderful as can be found in the region of romance. Smith explored the country, and was the first person who ever gave a map of it. At first, travellers, miners, and a few assistants, came to Virginia; the imagination of the patentees being diseased by the stories of gold and precious stones which they had no doubt could be found here. The next year they grew more rational, and brought Dutchmen and Poles to make glass and potashes. In 1609, a new charter was obtained, and fresh vigour given to the enterprise, but still more attention was paid to settling the offices, Governour, Lt. Governour, Admiral, Vice Admiral, and Members of Council, than to the great interests of planting a thriving colony. The whole was preserved by the friendship of Pocahontas, the daughter of King Powhatan, and the prudence and bravery of Captain John Smith. It seems to be a law of nature, that a colony, sent from any country, never feel at home, until they commence the cultivation of the soil: fifty years of traffick would not wed a people to a new situation so completely, as the planting and reaping of a few acres for a single year. There is a strange delight in seeing the products of industry springing from the bosom of our mother earth; her fruits and flowers are full of innocence, as well as of comfort and pleasure. Fifty or sixty houses were now built, several forts erected, and the Virginia colony appeared to be thriving in agriculture, manufactures, and fishing. This year Henry Hudson, an Englishman in the service of the Dutch, attempted to find a north-west passage to the East Indies, but his plan was frustrated by touching the eastern part of the continent. He then examined the coast to the Chesapeake. He also explored the river which now bears his name, but to what extent is not precisely known. The next year the Dutch sent a ship to open a trade at Manhattan, at which place a trading party was left. In 1613, Capt. Argall arrived from England, and compelled them to acknowledge allegiance to Great Britain. The next year, a new Governour came out from Amsterdam, with a reinforcement, but the colony at first refused to acknowledge his authority. They afterwards submitted to him. A fort was built where Albany now stands, called Fort Orange. The colony prospered, and carried on the fur trade to a considerable extent. They wisely kept peace with the neighbouring Indians, and of course received all the advantage of their traffick. The whole country was one vast hunting ground, from Manhattan to the North Pole, and west to the Pacifick Ocean. Half a world was devoted to the animal creation, hunted by wild men who were in many respects but little superiour to the fowls of the air, and to the beasts that roamed the forests. New Amsterdam flourished under the protection of the Dutch, for half a century from this time, when it was taken by the English, and retained by them as a colony of the crown, until lost to England by the American Revolution, which commenced in 1775, one hundred and sixty-six years after the first settlement by the Dutch adventurers. The people in general were pleased with the prospect of change, and made spirited efforts to shake off British authority.

In 1613, John Rolf, an Englishman, married Pocahontas, the daughter of Powhatan. This connexion secured peace to Virginia for several years. She accompanied her husband, in 1616, to England, where she was received with great respect. The King and Queen paid her every attention. She died the next year as she was about returning to her native land. She was only 22 years of age when she deceased, deeply lamented by those of her nation, and by every Englishman who was a well-wisher to the settlement in Virginia. History scarcely furnishes a character, which, in so few years of human life, was a greater benefactor of mankind than Pocahontas. Her descendants are still living in Virginia. Captain John Smith sent a memorial to the Queen in her behalf, when she was in England, fraught with high and deserved commendations, proving her to have been a most noble friend to the colony.

In 1619, the King of England made an attempt to collect money to establish a college for the Indians, but

like all attempts of this kind, the plan proved almost abortive. The nature of savage life was, and is, and ever will be, at war with civilization. The wise may philosophize, and the good may exert themselves, but no permanent good can ever be effected by attempting their civilization. The very elements of their nature are at variance with the course of science, letters, and the arts.

This year the colony of Virginia was visited by a most distressing pestilence, which essentially retarded its growth. In fact they passed ten years in distresses, doubts, and painful forebodings; nor were their miseries at an end at the conclusion of this period.

In 1622, on the 22d of March, 347 of the colonists were massacred by the Indians. They fell upon friends and foes; the carnage was horrible, even in the higher classes of the colonists. Famine soon followed, and destruction seems to have driven her plough-share through all Virginia. Nine out of ten of the planters were destroyed. The parent country happily sent them succours, or they would have perished in a mass. If one takes a view of the means which had been used, and the effect that had been produced, he would say, that no history of colonization ever presented such a series of calamities, of famine, pestilence, and the sword.

The year 1620 is another memorable epoch in the history of North America. The religious disputes in the reigns of Edward, Mary, and Elizabeth, and which still continued after the accession of James, were the causes of this era.

The Puritans were among the most moral and best informed of the commonalty of England. They possessed a good share of English spirit, or as some might call it—obstinacy. The fires lighted at Smithfield were never to be extinguished in the religious world. Men had begun to think for themselves, even in religious matters. The Catholick power had long before been put down, in the reign of Henry VIII., and never arose, only momentarily, again. Calvin had assailed the church of Rome, and by sturdy blows had crumbled into pieces, in Germany, the massy buckler of Saint Peter. Luther had also come down in the plenitude of his strength, and made tremendous inroads upon the strong hold of the Catholick church. A new era was about dawning upon the world. The Puritans took a decided stand in England, and opposed all the corruptions of the church.

The year 1620 was rendered memorable by the landing of the pilgrims at Plymouth. Some of the English Puritans had, under the Rev. John Robinson, left England, and took up their residence in Holland, in 1607. In 1608, they resided at Amsterdam, and in 1609, they removed to Leyden. Beginning to fear that the strict discipline which they had prescribed to themselves, would become relaxed in this place, and finding that the Lord's day was not so strictly observed as they considered proper, they turned their attention to the new world, with the hope of there finding an asylum. After slight preparations for such a mighty undertaking, the adventurers left Leyden for England in July, and sailed on the 5th of August from Southampton for America; one of the vessels in which they embarked, however, proving leaky, they were twice obliged to put back, and were at length compelled to proceed on their voyage in the Mayflower alone, on the 6th of September. On the 9th of November, they discovered land at Cape Cod. Perceiving that they had by design or chance been carried too far north, they directed their course to the south to find the mouth of the Hudson; but the navigator, from fear or duplicity, pretended that he could not get south at this season of the year without great difficulty. After some discussion among the adventurers, it was agreed to land as soon as possible. On the 11th of November, a plan of government was fixed upon, and signed by forty-one of their number. The whole party of freemen amounted to 101 persons. Mr. John Carver was made governour for one year. Here commenced a republican form of government, which has lasted for more than two centuries. The 11th of December (the 22d new style) has been considered the anniversary of the landing of the pilgrims. They endured every privation, and this they sustained by a high religious feeling. They felt that they could worship

God after their own manner, having no mitre to bow to, nor a synod to answer; but they had made too many struggles for human nature to bear, and a third part of them were in their graves before the vernal sun had warmed the soil of which they had taken possession.

In 1628, a settlement was made at Salem under John Endicot. The adventurers suffered all the horrours of sickness and famine.

The next colony, and the best directed of all that had been attempted, was the one that settled in Massachusetts Bay in 1630. They had a fleet of 14 vessels, and brought 840 passengers of various occupations, agriculturists, and mechanicks. They had arranged their plan of civil government at home, but not exactly their religious one. This was done on the 30th of July, at Charlestown, where they established a church. Governour Winthrop, the leader, was a man of great learning and decision of character. They set out on a broad principle of constitutional rights, and have ever since maintained them. The first general court of the Massachusetts colony was held at Boston, on the 10th of October of this year. Isaac Johnson, one of the best men in the colony, died soon after he had made his location in Boston. He was a pious, liberal man, of good manners and ample estate; he had married Lady Arabella, daughter of the Earl of Lincoln, who died soon after she landed at Salem. She has ever since been a theme of praise among the historians of Massachusetts, for she was high-born, pious, rich, and withal beautiful. She married Mr. Johnson from a love of holy men, and a desire to see a church built up in the new world. The ways of Providence are inscrutable.—"She who had titles, wealth, and fame, sleeps without a stone or name," in an undistinguished grave. Saints wear not their crowns on earth.

The Indians in 1636 began to manifest a hostility towards the whites: the next year a victory, almost exterminating, was obtained over the Pequods. The first impressions are strong, and this awful slaughter of the Indians struck them nerveless for a long time. They believed that the Great Spirit had deserted them or that the Englishman's God was the strongest.

The first settlement in Maryland was commenced in 1633. For this enterprise the world is indebted to the first and second Lords Baltimore. They laid the foundation of the province on the broad basis of security to property and freedom in religion. The emigrants, on their arrival, proceeded honourably, peaceably, and it may be said prosperously.

In 1635, Connecticut was first settled by John Winthrop, son of the governour of Massachusetts. He brought out a commission from Lords Say and Seal, Brook, and others, to begin a settlement at Connecticut, of which he was appointed the governour. Winthrop had many of the virtues of his father, and the plantation flourished. This year Massachusetts received a great influx of emigrants, some of them of distinction, among whom was young Sir Henry Vane, who was afterwards chosen governour, and kept a great parade of office, having halberdiers as a guard when he went to church.

In 1637 appeared Ann Hutchinson, a woman of talents, but an enthusiast, who gave lectures upon divinity. She set the whole country in a flame. A Synod was called, and eighty-two errours propagated by this gifted woman were condemned: she was excommunicated, and was obliged, after the death of her husband, to leave New England. She, with her family, 16 in number, were all, except one, massacred by the Indians. This, some considered as a judgement upon her. It would not however answer to test the doctrines of the Apostles by such judgements.

This year a publick school at Newtown was made a college, and called Cambridge, in honour of the college of that name in England.

A settlement was commenced in New Hampshire by John Wheelwright, and others.

In 1641 the General Court of Massachusetts established a hundred laws, called the body of liberties. They were drafted by Nathaniel Ward, a clergyman of Ipswich, in the commonwealth, who had been a lawyer. These laws contained all the fundamental principles, found in our constitutions and civil code throughout

the United States. Ward was a firm friend to the freedom of his country, but he had a well-balanced mind, and constituted his *Body* of laws so as to meet the future wants of the people. In 1643, a union of the New England colonies was formed, to advise and assist each other in case of danger from any quarter; and there were sufficient causes for this movement, which was then done in good faith, and has been kept in sincerity up to the present time. New England is, and ever has been, virtually one family. They are, in general, moved by the same impulses, and follow similar pursuits.

In 1636, Rhode Island was first settled by Roger Williams, a clergyman, at a place which he then called Providence, and which still bears the same name. He was a man of a bold independent mind, but his doctrines were not acceptable to a great majority of the people of Massachusetts; he therefore left them to take up his residence among the savages of the wilderness. He formed treaties with the Indians, became a great favourite with them, and made himself acquainted with their language. He went to England, obtained a charter, and filled the offices which he held in his small province with great judgement, though his life was marked with some eccentricities. A large and wealthy city now flourishes where he set up his log cabin, and trusted to Providence.

In 1646, the legislature of Massachusetts passed the first act for carrying the gospel among the Indians, and John Elliot of Roxbury, at the recommendation of the clergymen of the province, was set to work to translate the Bible into the Indian language. This Herculean labour was performed by him with incredible despatch, and was printed at the press in Cambridge, with many pious tracts. This gave the good man the title of "The Apostle to the Indians," which he has ever since retained. It is not for us, of the present day, to decide the amount of good effected by this great labour, in a religious point of view; but it certainly was a great political service, as many of the Indians were neutralized by it. Savages are in general grateful for services rendered; and when they saw their good religious father was solely enlisted in making them Christians, if they did not comprehend what this was, they perceived that such was his zeal and affection, that it was something he thought essential to them and their children.

In 1649, a revolution took place in England, and Charles I. was beheaded. The house of Lords was put down, and what was called a commonwealth, established under Cromwell. This, which in the end did much good in England, was not without its beneficial effects in some parts of the new world; not that New England ever was in favour of Oliver Cromwell, but they hated all arbitrary power. Charles II, still retained his authority in Virginia, but did not venture to do any thing to control New England. Under Cromwell, in 1651, the parliament passed the famous navigation act, from which sprung the American revolution, more than a century afterwards, when the colonies had increased, and that act had become oppressive in the extreme. This was not, in all probability, contemplated at the passage of it.

In 1660, Charles II. came back to London, not the least improved by his misfortunes. One of his first acts was offensive to the American colonies, for it perpetuated the navigation act with additional severities It enacted that "no sugar, indigo, ginger, tobacco, cotton, fustick, dying-woods, of the growth of English territories in America, Asia, or Africa, shall be transported thence to any other countries than those belonging to the Crown of England, under the penalty of forfeiture; and all vessels sailing to the plantations were to give bond to bring said commodities to England." This was considered oppression by all, and outrageous by some of them, and they never did fully comply with it. Another affair concurred to excite the colonies; this was the rage shown by Charles II., because the provinces would not give up the judges of King Charles I., Whally and Goffe, who had fled for protection to New England. The royal messengers found it impossible to get these fugitives into their power. The governours, clergy, and all the people, protected them, and they had to return without effecting the great object of their mission.

These distinguished men lived in New Haven, and afterwards in Hadley, in perfect retirement and safety for many years. The hearts of freemen are the best hiding-places for the enemies of tyrants. The emissaries were often almost within an arm's length of the objects of their pursuit, but no royal smile or bounty ever made a partizan amongst the provincials.

In 1662, Sir Henry Vane, who had figured as governour of Massachusetts, and was one of the Cromwellian party, was executed for high treason. He was an aristocratick puritan, and with the pretended simplicity and austerity of a saint, had the ambition of a Cæsar.

In 1663, the province of South Carolina was formed, and liberty of conscience was allowed by the charter.

In 1664, Nova Cassova, or New Jersey, was settled under the auspices of Lord Berkeley and others.

In 1673, New York and New Jersey were taken by the Dutch from the English, which they kept until the next year, when, by a treaty between England and the States General of Holland, they were restored to the English.

In 1675, a war broke out between Philip, king of the Wampanoags, and New England. Philip was a savage possessing the highest powers of mind. A few years before this, he had renewed the treaty made by his father with the colonists, and in a time of profound peace, took occasion, as is conjectured by some historians, to visit the tribes of Indians from the St. Lawrence to the Ohio. This conjecture is founded upon the fact, that many of them, in after times, had traditions of King Philip's visit. It is also rendered probable, from the length of time he was absent, and the well known rapidity of the movements of the sons of the forest. Massacres occurred in several places, which Philip disavowed as proceeding through his orders. These were so many signals for the movement of distant tribes to the east and west of Mount Hope, the royal residence. The war was now raging fiercely on Connecticut river, and various other places, and the Indians were frequently victorious. The whole of New England became sadly alarmed, and were aroused to save themselves from annihilation. In December, the Massachusetts forces being joined by those of Plymouth and those of Connecticut, determined on a desperate resistance. This was on the 13th of December. The army was fortified in a swamp at Petaquamset. The colonists commenced their march at day break on the 19th, and reached the edge of the swamp about noon. The Indians were soon traced to their strong hold, and the troops rushed on to effect an entrance; this was done, but the Indians made such deadly fires upon them, and killed so many officers and men, that they were obliged to retreat. Enraged at their loss, and fighting for existence, they continued to assail the strong hold, and became masters of it, as the sun was going down. The victors seized one of the torches of the savages, and the fort and numerous wigwams within it, were soon in a blaze. A thousand Indians are supposed to have perished in the flames, or to have fallen in the battle. Of the allied troops, nearly a hundred were killed or died of their wounds, and a hundred and thirty-five wounded. This was a grievous blow to the Indians, but Philip was still as fierce and active as ever. He commenced the campaign in a little more than a month after this disaster, and made devastation and blood follow his footsteps. Philip was greatly reinforced, and the war whoop was heard in almost every village on the frontier. The Narragansets plundered Warwick of horses, cattle, and sheep.

On the 10th of February, 1676, fifteen hundred Indians fell upon Lancaster, and burned a considerable part of the town, and killed or made prisoners some forty or fifty of the inhabitants. Medfield was next surprised, and a part of the town burnt. Weymouth soon after suffered. On the 12th of March, they laid the town of Groton in ashes.

On the 17th, Warwick was entirely destroyed. Marlborough, Rehoboth, Providence, and many other towns, greatly suffered. Capt. Wadsworth, who was sent from Boston to bring help to the towns now in tribulation and danger, was surrounded by the enemy, and his whole forces totally

destroyed. On Connecticut river some advantages were gained by the English. In the action called the Fall-fight, the enemy lost several hundred of all ages and sexes. During the ensuing summer months, the colonies were in arms; hardly enough were left at home to put the seed into the ground, or reap the harvest. Philip, as well as the colonists, began to find the war press heavily. He returned to the neighbourhood of Mount Hope. He had grown desperate, and came with a few followers, to light up his warlike mind, at beholding the country of his ancestors. One of his party betrayed him, and showed his haunts to the great Indian-killer, Colonel Church. Philip was in a swamp; Church took possession of all the avenues to it; and as Philip fled, an Indian and a white man were in his path; the gun of the latter missed fire, but the Indian shot him. The whole country rang with shouts of joy; the master spirit of the great and extended league was gone, and peace of course must inevitably ensue. The Indians now sued for it. Philip expired in the cause of patriotism. He and his enemy were on the plank together; one must sink, that the other might swim. It was his fate to perish, and with him the hopes of the red men.—Pillage, plunder, and conflagration, ceased when he fell; but the wounds he had given were deep, and required a long time to be healed.

While New England was suffering by Indian wars, Virginia was torn with intestine commotions. Nathaniel Bacon, a daring fellow, led on the insurgents with considerable success. Jamestown was burnt. Many of the evils of civil war ensued, but the death of Bacon put an end to them. These calamities arose from the bad management of the men in power.

In 1680, a comet made its appearance, and alarmed many in England and America; but at this time it might rather have been called any thing, than a forerunner of pestilence and war, for now peace was established. If it had appeared a few years before, it then might have been so considered.

In 1682, the settlement of Pennsylvania was commenced by William Penn, a learned and judicious Quaker, born in high life, the son of a British Admiral, and heir to a large fortune. He began wisely, proceeded judiciously, and founded a province on the broad basis of sound policy. In less than sixty years from the foundation, the state of Pennsylvania was the second in respect to trade, judging by the custom-house books, of all the colonies in North America. He laid out, and began the building of the city of Philadelphia, and lived to see its extraordinary prosperity, far exceeding in its growth any other city or town of the British Provinces.

James the Second, in 1685, succeeded his brother Charles, and discovered all the folly and obstinacy of his predecessor, without any of the graces of his manner, or the carelessness and ease, which often proved an advantage to those under his sway. The short period of four years filled up the measure of his iniquity; the empire passed to his daughter and his son-in-law. William, Prince of Orange, had married Mary, the daughter of James; and they were called to the throne by the parliament of Great Britain, and the consent of the people. This was a contract between ruler and people, which enlarged all the doctrines of the Magna Charta, and broke down the oft repeated dogma among nations, of the divine rights of kings. This news arriving in Boston, produced a revolution. The colonial tyrant, who had strutted his hour, and shown his little brief authority, was seized and imprisoned, and a council of safety created. The former governour, Bradstreet, then nearly ninety years of age, was made president of the council. The other colonies soon hailed the change in the British government, and acknowledged William and Mary as their rightful sovereigns, and were ready to act their part for the dignity and glory of the British empire.

In 1690, commenced the first French war, which lasted, with fearful intermissions, until the year 1769, a period of almost eighty years. Count Frontenac made an incursion into the state of New York, and did great injury to Schenectady, destroying the buildings, and also most of the inhabitants. This incensed the

whole country; and New England prepared to avenge the insult, and chastise the assailants. They now began to feel that France, in their northern possessions, was to be a scourge of New England; and, "Canada must be ours," was henceforth their motto. The state of Massachusetts armed and equipped a force for the reduction of Canada. Sir William Phipps, blushing with his late honours, was designated the commander of the expedition; but, owing to the ten thousand delays incident to fitting out an armed force in a new government, he was unable to reach Canada until late in the autumn; the stormy season coming on, he made a failure of it, and his fleet returned home without any laurels.

New England was in a state of activity and enterprise. Manufactures were carried on far beyond what the British knew any thing about at this time. The cod fishery was full of life and energy; and, at the same time, the whale fishery commenced at Nantucket on a tolerably broad scale. The people of Cape Cod had followed this employment with success for several years before, but only on the immediate coast. The whalers of Nantucket now pushed farther south and north than had been done before, and they found their account in it. One great spirit of enterprise seemed kindled up along the sea coast, and to prevail in the interiour.

In 1691, New York was roused to a war against the Indians and French in Canada; in fact, a perpetual war seemed to be determined on, for none could foretel when these hostilities were to end. Major Schuyler collected a large party of Mohawks, passed over Lake Champlain, and carried fire and sword into the French settlement, showing them that they were not to be always assailants.

In 1692, Sir William Phipps, who still retained his popularity, notwithstanding his want of success in the Canada expedition, came out from England with a new charter for Massachusetts, which, though not precisely acceptable to those friendly to the old charter, was even by them considered a tolerably good one. He was appointed governour by that instrument, and began the duties of his office with the good will of a majority of the people. He was a man of strong powers of mind, had all that compound spirit of democracy and aristocracy which is often found in those who suddenly rise in the world; who wish to live on terms with the great and to secure the humble, and are obliged many times to play a double game. When the learned Mathers wished him to destroy all of a familiar spirit, he gave them every assistance. A court was appointed by commission, to try all witches; but he found at length that he had been duped, and joined to stop the current of delusion. This infatuation in the end was beneficial, for it set men to thinking, and made them less confiding in the opinion of ecclesiastical leaders. Phipps's administration was short; he was never fitted for a statesman or a general, but was a good enterprising mechanick. The colony was in great jeopardy from the power of Louis XIV.; he formed gigantick plans which unquestionably were to embrace the conquest of all North America, from the highest northern latitude to the mouth of the Mississippi. Concealing his intentions as well as he could, he set about carrying them into effect. He established a company for the West Indies to exist for fifty years.—This was to be one of his instruments to bring about his intentions.

In 1702, William the Third died, (Queen Mary having deceased before him,) and Anne, Princess of Denmark, came to the throne of England. Her disposition was good. when she erred it was from bad advisers, not from wayward intentions. The congratulations on her elevation were not made with great spirit, notwithstanding the people had heard a good report of her talents and virtues. But it was a gloomy season; the dread of France was upon every mind, and a pestilence was raging through many of the principal cities and towns. In New York a great and sweeping sickness prevailed; it was probably the yellow fever: most of those seized with it died, as there was not much medical skill in the treatment of it at that day. In Boston, at the same time, the small pox was raging, to which many fell victims. A knowledge of inoculation had

not then been brought from the Levant; and modern experience has since discovered that the disease was improperly treated by the physicians of that age.

The fears entertained of the French now began to be realized. In 1704, a body of French and Indians made an attack upon Deerfield, in Massachusetts; after massacreing the helpless inhabitants, and burning the town, they set off with such prisoners as were able to march; those who fainted with fatigue, were relieved by the tomahawk. These captives were, a year or two afterwards, redeemed by their friends or by the legislature. In 1708, another body of Indians made an attack upon Haverhill, situated on the left bank of the Merrimack, within thirty miles of Boston. The clergyman, Mr. Rolfe, was killed by a ball passing through the door, which was barred; which may now be seen, being a double one, without pannels. His two infant daughters were preserved by the nurse, who fled with them to the cellar as soon as she heard the alarm, and placed the children under two large washing tubs, on the upturned bottoms of which, as tradition says, she set two pans of milk, from which the Indians drank; but the children, silenced by fear, were not discovered.

From 1708 to 1713, many abortive attempts were made upon Canada, and numerous Indian conspiracies were formed, but nothing to weaken either power happened until the treaty of Utrecht. This treaty gave the colonies a breathing spell, and they began to explore and survey the wilds beyond them; but tranquillity was of short duration. A powerful and warlike tribe, in 1715, threatened South Carolina with entire destruction. Vigorous efforts were made to repel them, by the governour, who was a man of energy. He made a levy *en masse*, of faithful slaves and all. The blacks have a strong antipathy to Indians; and, of course, made good soldiers in such a war. The Yamasses made many desperate attacks, but were in the end repulsed by Governour Craven, and driven into Florida. The people of South Carolina suffered greatly in this war, nearly a third part of the fighting men being slain. During this time, Pennsylvania was free from Indian warfare. If there was no chance in this, does it not speak volumes in favour of William Penn?

The pirates who had succeeded the bucaniers, were now troublesome on the coast of North America: spirited measures were taken by the governours of the several states, and sometimes with success, to destroy them. Bellamy, a pirate, was wrecked with his whole fleet, and many carcasses were thrown on the shores of Cape Cod. A few of his men saved themselves only to perish on the gallows in Boston. Bellamy had been for some time a terrour to all the mariners of New England.

It is a little remarkable, that the two articles, now of the most general consumption in the United States, potatoes and tea, were not brought into the country until about the close of the first century from the landing of the forefathers of New England. A poem, dated at Newton, near Boston, April, 1717, mentions the fact, that China ware and other products (unquestionably tea) were brought into Boston just before. Dr. Boylston allowed it to be drank sparingly in 1721, when he inoculated several hundred patients for the small-pox.

Cotton Mather, who had filled a great space in the literary, religious, and political world, died in the year 1728. His father, Increase Mather. President of Harvard College, died not long before him. These men were learned, bigoted, and influential; and were also useful, though at times injurious, to the age in which they lived. They diffused knowledge, while they scattered errour; they gave sound advice, while they insisted on the observance of useless dogmas. The good they did, lives after them, and the evils they were guilty of, should be "interred with their bones," so far as our feelings extend; but history should write out her records fairly. The learned men who came from England, when the rage of emigration was at the highest, were now nearly extinct; a race which, for learning, sanctity, perseverance, and energy, was never surpassed in the annals of man. They had their errours, but these were, by Providence, made subservient to the good of the whole. Education had been attended to in the bringing up

of their children of the second generation, but none of them surpassed their fathers. Among those who first arrived in this country, were many fine Oriental scholars, whose learning served only to amuse themselves, or to raise the wonder of their flock at their acquirements. Hudibras, in derision, said of their emigrating to this wilderness, that

> "Hebrew roots are always found
> To flourish best on barren ground,"

not applying this, as it has usually been, to the intellects of the men who love Hebrew, but to the country they had chose for a habitation. They were men fitted for the times, and filled up the measure of their destiny: founders of an empire, they saw in prospect its glories, and rejoiced that they had lived at such a period.

On the 22d of February, 1732, George Washington was born in Westmoreland, Virginia. At the time of his birth, there were twelve colonies in America, more or less dependant on England for rulers and laws, all claiming privileges and immunities by charter. They were scattered over an immense territory, just beginning to thrive amidst difficulties and dangers. The whole amount of the population of these provinces was not more than eight hundred thousand, and these not intimately acquainted with each other. The northern and eastern population were thriving upon their agriculture and their commerce, yet were cramped in their manufactures by the severe restrictions of the navigation act. The staple article of the south was then tobacco, and being mostly an article of cultivation rather than of manufacture, excited no jealousy of the northern country. At this time the sagacious politician might have foreseen many things which have since transpired. In the first place, the country was sufficiently extensive for the population to increase a hundred fold. The seeds of intelligence were well sown in the community, and the love of independence had sprung up—"and like the chamomile," the more this spirit is trodden on, the more it grows. The doctrines of perpetual relations of colonies to the mother country, were beginning to be questioned, and by some critically analyzed. The English were proud and obstinate; and their descendants had a good share of both of these ingredients in their composition. As the former assumed the slightest air of importance, the latter thought it to be a duty to check all ambitious views. Irritations began on nominal points, extended to essentials, and by slow degrees alienated the affections of the colonies, and increased the consequential air of the mother country. From this period till 1775, every day was paving the way for the independence of the American colonies, and in process of time it became indispensable. The next steps taken on either side will discover this; and every event should be considered as leading with a fated directness to that measure. The soil was held by the yeomanry in fee simple, and every one who cultivated an acre was lord of his manor. This is the foundation of individual independence. The laws of property affect nations more than the laws that govern personal actions.

In the forty-three years which passed from the time of Washington's birth to his taking command of the American army, the people had multiplied to nearly 3,000,000, a sturdy race of hardy men, who had sound minds, and those well imbued with the great principles of freemen. Washington was well acquainted with the feelings, habits, and powers of the people; he knew also the power and disposition of England; thus prepared, he drew his sword for the perilous conflict, and fought it out like a man. He was surrounded by those who entertained similar sentiments, and who wanted nothing of corporeal or moral courage.

Georgia was settled by General Oglethorpe, January, 1733. He called a convention of the Indian Chiefs, and made a treaty of friendship with them. The Indians at that time were numerous. The Cherokees had more than six thousand fighting men, the Choctaws five thousand, the Upper Creeks two thousand five hundred, the Chickasaws seven hundred. They were warlike nations, and lived more compactly than the northern tribes. It was owing to the forbearance of these lords of the soil, that Oglethorpe and his little body of 116 persons got foothold in

the soil. There has not as yet been any full and satisfactory history of Georgia.

In 1735 the Cynanche Maligna made its appearance. It broke out in May, at Kingston, New Hampshire, and raged in that town during the summer. It is said that it was first taken by a person who had been skinning a hog that died of an inflammation in the throat. Of the first forty seized, all died. It continued with great severity the ensuing winter, and through the next summer; more than a thousand died in New Hampshire with this scourge of God; 900 of these were under ten years of age. The disease became milder as it travelled south. In Boston 4000 had it, of which number not over 120 died. A fourth part of all the inhabitants had the disease; it spread all over the colonies. Many years have elapsed since a case of the "throat distemper" has occurred.

1741—There were frequent fires in the city of New York—the negroes were discovered to be incendiaries; thirty were burnt, eighteen were hanged, and many were sent off to Georgia and other places. This year Dr. Franklin began a magazine: the work appeared on the 1st of January, and was the earliest of the kind published in the colonies, and was respectable for its literary character.

1745—The colonies were in a flourishing state. The shipping of New England alone consisted of more than 1000 sail, exclusive of fishing craft, which were numerous. The other colonies were in great prosperity. From the custom-houses it was ascertained that Boston was then first in commerce, Philadelphia second, New York third, Charleston fourth, Newport fifth, and Perth Amboy sixth. This year Louisburgh was taken by the New-England troops, assisted by a squadron under Admiral Warren. This was a heroick exploit.

1750—Governour Clinton of New-York made a treaty with the Indians of the Six Nations, at Albany.

In 1752 the new style was introduced into the colonies. From this time, the year, instead of beginning on the 25th of March, now commenced on the 1st of January. The new style began on the 3d of September, now called the 14th. Pope Gregory XIII. had corrected the calendar 170 years before, but the protestants were slow in adopting a demonstrable truth, as it came from the pope of Rome. A tremendous tornado was felt at Charlestown about this period, and some were bigoted enough to believe that it was for changing the time according to the calculations of the pope.

1755—This year Braddock marched from Virginia to take Fort du Quesne. George Washington of Virginia, who had resigned his command of a regiment because he was superseded in rank, was invited to act as aid to Gen. Braddock, and accepted the invitation. The army moved on the 10th of June, and reached the Monongahela on the 8th of July; the fight was on the 9th. The English were defeated by the French and Indians with a very small force. The place where they fought was an open wood, with high, thick grass; and the assailants firing on the solid columns of Braddock's army, were almost entirely concealed. The Virginia militia behaved well, and preserved a remnant of the army by their coolness and valour. Braddock was mortally wounded, and brought off the field on a litter, but died the next day in the arms of Washington, in Colonel Dunbar's camp. Of eighty-five officers, sixty-four were killed or wounded.

September 8th, 1755, General Johnson fought Baron Dieskau near Lake George, and defeated him. Col. Williams was slain, and also the famous Indian warrior Hendrick. Baron Dieskau was mortally wounded. This success seemed to rouse the spirit of the colonies; for until this battle, for many years past, the French and Indians had been victorious.

On the 19th of November, 1755, there was a severe shock of an earthquake felt in North America. It demolished several old houses, threw down several chimneys, and rudely shook the steeples of many churches. In Massachusetts and Connecticut, it was more terrible than in other places.

1757—Montcalm took Fort William Henry, at the southern end of Lake George. The garrison, commanded by Colonel Munro, made a desperate resistance, and did not

capitulate until every shot was fired. The garrison was to be allowed the honours of war, and protection against the Indians until within a short distance of Fort Edward; this was disregarded, and a horrible massacre ensued, which has left a stain on the otherwise spotless fame of the great French general.

1758—General Abererombie commanded on Lake George. July 5, he sailed down the lake on a most beautiful day, with nearly sixteen thousand troops, English and provincials, on board of 1025 whale boats and batteaux, with a fine train of artillery, to attack the French at Ticonderoga. The fight was miserably managed. Lord Howe, a gallant officer, was killed, and 2000 of the troops, without doing the French much injury, they being so well protected by their works. Lord Howe was a great favourite with the Provincials, and their affection for him was carried so far, that Massachusetts erected a monument to his memory in Westminster Abbey. The Rangers, a famous border corps, under Rogers, Stark, and others of distinction, were in this battle, and did all that was effected that day. This year died the Rev. Jonathan Edwards, in the 55th year of his age. He is considered by all the metaphysicians of the present day, to have possessed as acute a mind as Aristotle. Sir James McIntosh, in his great work on Ethicks, has paid him a deserved compliment.

1759—General Amherst succeeded Abererombie. Amherst brought his forces against Ticonderoga, and Wolfe against Quebec; both armies were successful. Wolfe fell in the moment of victory. The French were commanded by Montcalm, who was mortally wounded. The peace of 1763 put an end to the French power in the North, and hastened the settlement of the frontier.

1761—James Otis was called on by the merchants of Boston and Salem, to argue the question of the constitutionality of the Writs of Assistance, which the custom-house officers of Boston prayed the supreme court to grant, giving them power to enter all places and search for goods, suspected to have been smuggled into the country. His arguments set men to thinking upon the nature of their rights, and was more highly applauded than any speech ever delivered in the country. Some parts of this able argument have been preserved by John Adams, who was present at the hearing.

1764—Several anonymous writers made their appearance in different parts of the country, in defence of the rights of the colonies. James Otis published a work, under his own name, entitled, "The rights of the British Colonies asserted and proved."

1765—The Stamp Act, the first in the series of oppression that roused the colonies to arms, was passed this year. The passage of it was most spiritedly opposed by men of talents and liberal feelings, in the Houses of Commons and of Lords, but to no avail. The colonies took fire, and the act was every where resisted. The distributers of stamps were hung in effigy all along the sea-coast. Out of these discontents grew preparations for a national union, which was the seed of our national independence. The stamp act never went into effect; the business required to be done with stamps, being effected by some other method. The ministers of the law dared not proceed, the voice of the people was so terrific. This year, John Adams published a "Dissertation on the Canon and Feudal Law," which was done for the purpose of aiding the liberties of the colonies. It bears marks of a strong mind, devoted to the cause of the rights of man, and though superseded by deeper research since, still it may be read with profit now. This year, Doctor Franklin was examined before the House of Commons, relative to the repeal of the stamp act. His answers, and whole conduct, on this occasion, is the brightest gem in the diadem of his fame. Camden, in the House of Lords, reasoned with great force in favour of the colonies, and William Pitt, afterwards Earl of Chatham, in the House of Commons. The presses in America were now teeming with patriotick addresses, and the minds of the colonists kept up to fever heat.

In 1768, associations were formed in different states, the members pledging themselves not to import articles of consumption from Eng-

land. This year, the first British troops arrived in Boston, and were viewed with a jealous eye. The town authorities were required to quarter these troops; this was peremptorily refused, nor would the council of the commonwealth do any thing for them. The first regiment was hardly provided for by the government, when more arrived, and increased the disgust of the inhabitants towards the British ministry.

On the 5th of March, 1770, was perpetrated, what has ever since been denominated in American history, the Boston massacre. The soldiers, while under arms, in the open street, near the custom-house of that town, were insulted by the populace, pelted with snow balls and stones, and dared to fire. One of the soldiers fired at a man who had thrown some missile at him, and six others fired in a few seconds afterwards. Three of the inhabitants were instantly killed, and five or six others were severely wounded, one of whom soon after died. The soldiers, with their captain, were committed to prison. The excitement was tremendous for some time. The trial of Captain Preston and his men, did not come on for many months. The men were first tried and defended, on the ground that they stood in self-defence, and that they only obeyed the law of nature, and this sanctioned by the order of their captain to fire. Six men were acquitted, and two found guilty of manslaughter, who were afterwards slightly punished. Preston's trial came on next, and it was satisfactorily proved that he gave no orders to fire, and he was acquitted. John Adams and Josiah Quincy were of counsel for the prisoners. They were both stanch Whigs, and as much incensed against the British government as any two men in the country, for sending an army among us; but they were sagacious enough to make a distinction between the acts of a government, and those of individuals. Their exertions in these trials gained them great credit for talents and moral courage; but the effect of this shedding of blood, was not lost upon the minds of the people. This event was commemorated by orations for many successive years. In this year there was a change in the British ministry; Lord North came into power as premier, with the avowed intent of carrying into effect the measure of taxing the colonies, and bringing them to obedience by coercion. The conciliatory advice of Pitt and Camden was wholly disregarded, and all the knowledge and predictions of Pownell treated with contempt.

In 1772, the Gasper was burnt. The British made this a strong pretext for complaint; accordingly a commission arrived under the great seal of England, directed to Governour Wanton of Rhode Island, and the judges of several of the colonies, requiring them to examine into the affair, and report the facts to his majesty.

In 1773, the tea question was agitated in Boston. Other parts of the act imposing duties was repealed, but the duty on tea was continued, to show the power of the mother country. It was so managed that tea came cheaper to the colonies than to the mother country, as the duty of one shilling sterling was taken off all exported to America, and only three pence on the pound charged when they arrived. This was supposed by North and his coadjutors to be a most conciliatory measure; but they never took into consideration, that it was the principle, and not the amount, against which the colonies contended. Three ships laden with tea arrived at Boston; the masters of the vessels saw the opposition, and were willing to return home, without breaking bulk, but the consignees would not permit them to depart. At this juncture, a number of men, in the disguise of Indians, went on board the tea ships, took possession of them, and threw all their cargoes overboard. This was considered as the most gross act of rebellion that had been offered to the British ministry; and the question then was, who should yield? The tea merchants in England clamoured for an indemnity from the ministry. The ministry said that Massachusetts should pay for the loss. The colony denied all participation in the act, and considered it as a common loss, for which individuals alone were answerable. The persons engaged in this transaction have never as yet been disco-

vered. The King took alarm at this affair, and in his message to parliament, represented the act as subversive of the government; this encouraged the parliament to pass the famous Boston Port Bill, a measure which virtually struck the port of Boston out of the sea-board, as to trade and navigation. But this was not all; an act followed, by which every person, charged with treason, was to be sent to England for trial. The whole colonies saw that their liberties were to be annihilated at a blow. It was not one port alone, but in their opinion, all ports were shut up. They therefore, in opposition to the measure, made a common cause, and a spirit of determination, unknown before, pervaded all ranks in society. The question was no longer one of ordinary policy, but of political existence. Passive obedience and *non-resistance* could alone satisfy the British government. The amount of taxes became nothing in their eyes; it was alone the object to humble or conquer the restless disposition of the people.

On the 4th of September, 1774, delegates from eleven colonies formed themselves into a congress at Philadelphia, and Peyton Randolph was chosen speaker. Each colony had but one vote, however large its delegation. This congress sent loyal addresses to the King and the people of Great Britain, and an appeal to the inhabitants of other parts of British America. These addresses gave proof of the most exalted talents and good sense. In September, Governour Gage issued writs for the holding a general assembly at Salem, but afterwards countermanded his orders by proclamation: the members were however chosen, and they deemed it expedient to meet, notwithstanding the interdict. When they were assembled, they found no governour, but they resolved themselves into a provincial congress, and chose John Hancock president. Towards the close of this year the British government prohibited the importation of military stores from England to America. This act produced some commotion in several of the states, particularly in New Hampshire and Rhode Island. The most distinguished men in Virginia took alarm at the encroachments of arbitrary power and South Carolina was awakened by the address of Judge Drayton to the grand jury, which was replete with sound and liberal doctrines. Virginia was at this time vexed with a bloody Indian war, but had the good fortune to bring it to a close just before the revolutionary contest commenced. The Ohio Indians had made sad havock of the Virginians under Colonel Lewis.

The year 1775, will be an ever memorable epoch in American history. Chatham was still making every exertion to bring about a reconciliation between Great Britain and America, but Lord North had the confidence of the King, and the control of the parliament, and every conciliatory measure was negatived. New York petitioned parliament, and secured the great talent of Mr. Burke in presenting and supporting their petition; but all to no avail. The King was most pertinaciously supported by his ministers, and every word and deed were apparently full of threats and darkness to the colonies. The drama of the revolution was now about to open,—all things previously done were *but notes of preparation.*

On the evening of the 18th of April, Dr. Joseph Warren, then chairman of the committee of safety at Boston, received information that Governour Gage was about to send a detachment to Concord, 18 miles from Boston, for the purpose of taking possession of some military stores and provisions deposited there by the provincial congress. The chairman sent messengers in every direction to alarm the country. British sentinels and officers were scattered upon their rout, to prevent any intelligence preceding the detachment; but the messengers, by their diligence and skill, eluded them all. Eight hundred troops under Lt. Col. Smith and Major Pitcairn, embarked from Boston Common, and landing at Cambridge, took up a silent, expeditious march towards Concord. The troops reached Lexington between day and sunrise, on the morning of the 19th of April. Pitcairn led the van, and seeing a company of minute men who were then formed in order for exercise, or to act as they should receive orders, he, gal-

loping up to them, ordered them to disperse, calling them *rebels*, and other opprobrious epithets. They stood seemingly questioning his right to interfere with them on their own ground. The major then rode to within a rod or two of them, and fired his pistol, and waving his sword, gave the order *to fire*. This was obeyed by the British soldiers, and a discharge of musketry, accompanied with huzzas, instantly succeeded. Four provincials fell on the first fire, and four on the second, as the minute men were retreating. There were some random shots fired in return; but the attack was so sudden, that no regular opposition could be expected. This was the signal for the country to rise. Blood had been shed; not by accident, not in the heat of passion, but in a cool, deliberate, settled plan of coercion. All scruples then in the minds of the colonists gave way. Every one considered himself bound to assume a defensive attitude. The British reached Concord about ten o'clock in the morning, and took refreshments at the village, while a small body of the troops were spiking two twenty-four pounders, and throwing a few cannon balls into some of the wells, and destroying about sixty barrels of flour.

The militia of Concord retired over a bridge north of the village. Here an active skirmish took place, the British firing first as at Lexington. Smith finding the provincials gathering so fast, thought it prudent to make tracks (as his pursuers called his retreat) towards Boston. In this flight, for it could be called nothing else, the British troops were severely handed. All the militia of the neighbouring towns, on horseback, and on foot, pursued the fugitives. For the distance of 7 miles, from Concord to Lexington, they suffered sadly, but here they met Lord Percy, with a powerful regiment of 900 strong. The fresh troops marched in a hollow square, keeping the exhausted ones in their centre. The provincials pursued; and, from behind stone walls, barns, and fences, kept up a galling fire on the British. When they reached Bunker's-hill, most of the detachment rested there for the night, as a great portion of the soldiers were unable to go any farther. The Somerset man-of-war covered their position, and they were not assailed during the night. This was a dear day's work for the British; for according to their own account of the battle, they lost 65 killed, 180 wounded, and 28 made prisoners, making a total of 273. The loss of the provincials was, 50 killed, 24 wounded, 4 missing, total 78. This *excursion for amusement*, as Pitcairn had called it when it was projected, taught the British what to expect from exasperated yeomanry. This battle was truly the first scene, in the first act, of the revolutionary drama. It gave proof that others besides grenadiers could play a part in the tragedy of war. An account of this battle was sent to England, and soon reached, by express, every part of America. Twenty thousand armed men seemed to spring, as it were, from the ground as avengers of blood, and asserters of the rights of men. Col. Buttrick was commander of the day at Lexington and Concord, but in fact every man fought on his own account and risk. Warren was in the fight, and a curl of his wig was carried away by a musket ball.

The British were now closely shut up in Boston, not daring to look out of the limits of the town. Fresh troops soon after arrived under Howe, Clinton, and Burgoyne, which augmented their forces to nearly six thousand men.

The American army had been quartered at Cambridge nearly two months, and no blow had been struck to rid the country of the British troops, or to encourage the people; some uneasiness seemed to exhibit itself in the camp and abroad, that more energy was not shown; but the wise thought to conquer by *Fabian wisdom*, while others were for more decisive measures. The army at Cambridge was known to be large enough to demolish the British, if they could but get at them. In this state of feeling, it was deemed proper to make some demonstrations of courage, and to show intentions of acting *offensively* and *fearlessly*. Col. Prescott was sent with the fragments, or rather the skeletons of three regiments, on the night of the 16th of June, to occupy a station on Bunker's-hill. On viewing

the eminence, properly called Bunker's-hill, he found it not an elligible spot. Then looking along to the right, he saw that a spur of the same hill, now called Breed's-hill, was the most proper in every respect for a battle ground. Considering that they were within the limits of their orders, Prescott and Col. Gridley, the engineers, began a redoubt on the right of Breed's-hill. It was about 140 feet square, with two open passages for ingress and egress. On the left of the redoubt, running northeasterly, was a breastwork of sods, not much over four feet high, which, however, did not, as has been stated, reach Mystick river, not extending one quarter of the way to it. The line from this breastwork was made of two posts, and rail fences placed about four feet apart in parallel lines, and between them was newly mown grass, making quite as good a screen for the militia, as the redoubt for the breastwork. General Ward, concluding from the firing from the summit of Copp's-hill, in Boston, that the British would make a struggle to get possesion of the works, offered to relieve Prescott and his men, but they unanimously declined the offer, yet earnestly insisted on a reinforcement. These were reluctantly given, as the commander-in-chief thought that an attack on his camp was contemplated, as it was a better place for a general action than Bunker's-hill, and in such a case he would be but indifferently fortified. Early in the morning, from the battery on Copp's-hill, one of the men in or near the redoubt was killed and buried on the spot; although the roar of the cannon from this eminence was incessant, no further injury was done by their shots: and in aid of this battery, the Lively man-of-war was brought to bear, and in fact she began the cannonade at early dawn. Gage, wishing to drive the Provincials from the hill, sent Major General Howe and Brigadier General Pigot, with ten companies of grenadiers and ten of light infantry, and some artillery, to perform this service. These generals reconnoitering the American army, on their arrival at Morton's point, where the navy yard at Charlestown now stands, thought it best to wait for a reinforcement from Boston. Howe waited for them, from about noon until after three o'clock, before the battle was commenced. The British began a slow march up the hill in two lines, stopping at times to give the artillery a chance to play; but the angle of elevation was such that it did but little execution. The Provincials wasted no ammunition; they had but a scanty supply, and were ordered to put four buck-shot to a bullet, and to reserve their fire until the enemy was at blank shot distance, and then to pour in upon them a volley. The effect was not more destructive than appalling. The British soldiery, expecting nothing but random shots, from undisciplined militia, were astounded at such deadly fires. The British lines broke in confusion; some companies had not twenty soldiers fit for duty when they were about to rally. The British officers had the greatest difficulty in bringing their troops again into line, and a second time they came towards the works, though with some wavering, and in less than fifteen minutes they retreated in still greater confusion than before. Clinton saw this from Boston, and hastened over to assist Howe. Both the generals addressed the soldiers—called to mind their former wreaths of glory—and expatiated largely upon the everlasting stain that would attach to them in being beaten by raw militia. Howe swore to them, that he would never survive the disgrace, if they were beaten that day. By this time Charlestown, consisting of four hundred houses, was in a blaze. This was done by Clinton, to terrify the neighbouring army. On the third attack, they were under the necessity of resorting to their military skill, not daring to risque the event on the score of bravery. Pigot, with a considerable force, took a circuitous rout around the south side of the hill, then came upon the south western angle of the redoubt, and instantly scaled the slight works. Pitcairn was with him, and was shot through the body, as he was about to leap into the redoubt. Pigot being a short man, was lifted by his soldiers upon the sods, from whence he jumped into the area without harm. The provincials were now attacked on the east and west; their

ammunition was exhausted; they had few or no bayonets, but after beating their assailants with the butts of their guns, Prescott ordered a retreat. Those at the breastwork retreated, and those at the rail fence followed. The Americans retreated over Charlestown neck northward; and until the commencement of the retreat, but few of them had been killed: their unwillingness to leave the ground, at the proper season, was the cause of the considerable numbers of the killed and wounded. Captain Knowlton, who had a fine large company, near Mystick river, moved up in good order, and covered the retreat of those from the redoubt and the breastwork. The battle was ended between five and six o'clock. The wind, during the fight, being brisk and westerly, blew the smoke directly in the enemy's face, and as the smoke arose over the heads of the British, the Americans as it were, looking under the cloud, saw where to fire. Prescott, during all the fight, was in the redoubt; the other portion of the Massachusetts militia were at the breastwork. The New Hampshire troops, under Stark, Dearborn, and others, were at the rail fence. They were marching from their native state towards Cambridge, and went on the battle ground from their own impulse, not having received any orders from the commander-in-chief. The British had between three and four thousand in the fight. They acknowledged 1054 killed and wounded, with a great proportion of officers. Their numbers slain was most unquestionably larger than acknowledged; for they brought between three and four hundred corpses, and buried them in the corner of a new burying ground at the bottom of the common in Boston; the others were buried on Breed's-hill, where they fell. The American force was stated to be fifteen hundred, but perhaps there were a few more at times, as volunteers came on the ground, expended their ammunition, and retreated, when they could do no more service to the country. The Provincials had 139 killed, and 314 wounded and missing, forming a total of 453.

The American officers that fell were, Col. Gardener of Cambridge, Lt. Col. Parker of Chelmsford, and Majors Moore and M'Cleary, all men of distinction and value, and heroes in the cause; and to these we must add Major General Joseph Warren. Some of these officers had parts of regiments under their command, and some were volunteers on the hill. General Pomeroy fought with Spartan bravery; he saw where his countrymen were, and then advanced to the fight.

Warren took no command that day. He had been but four days previously commissioned as a Major General by the Provincial Congress, nor had he in fact been sworn into office, except as every patriot had, an oath in Heaven, to live free or die. Warren was, at the moment of his fall, president of the Provincial Congress, and chairman of the committee of safety. He had put some one in the chair, and mounted his horse at Watertown, where the legislative body were in session, to come and encourage his fellow citizens in the fight. When he entered the redoubt, Prescott offered him the command, but he declined it, saying, "I come to *learn war* under an experienced soldier, not to take any command." He became the martyr of that day's glory. His death was deplored as a great calamity to the *cause* and to the *nation*. He was in the prime of life, only thirty-five years of age,—a spirit as bold and dauntless as ever was blazoned in legends or recorded in history. He was a prudent and cautious, but a fearless statesman; made to govern men, and to breathe into them a portion of his own heroick soul. His eloquence was of a high order—His voice was fine, and he could modulate it at his will. His appearance had the air of the soldier, graceful and commanding, united to the manners of a finished gentleman. The British thought that his life was of the utmost importance to the American army; indeed of so much importance, that they supposed they would no longer hold together after his fall. They sadly mistook the men they had to deal with. His blood was not shed in vain; *is cried from the ground for vengeance*, and his name became a watchword in the hour of peril and glory.

The humblest individual, who perished in that fight, was a substantial yeoman or an industrious mechanick

They were owners of the soil for which they fought. The battle scene was imposing. The ground was in the neighbourhood of a city, whose inhabitants were watching the progress of events, anxious for the nearest friends; while the roar of cannon from ships of war, and from floating and stationary batteries, was followed or commingled with incessant volleys of musketry; a well built, compact town was seen in one mass of flames, and all this was thought but the commencement of troubles—was a sight which was appalling to every American, and seemed to shake even the enemy, mind and soul together. The British troops, in considerable force, occupied the hill that night, and enlarged the redoubt to nearly twice the original extent; but they did not venture to light their fires; they laboured by the sinking, flickering lights, which shot up from the mouldering ruins of Charlestown.

For us, struggling for liberty, the event of this battle was most fortunate. They had done enough for honour; enough to produce an impression of their prowess on the minds of their enemies; enough to give them confidence in themselves; and they had learnt something in the way of preparing themselves to correct their errours of judgement in planning a fight. They had suffered enough to feel their loss deeply, yet not enough to weaken their forces. The wounds they had received were too deep to be healed at once; the sight was too awful to be soon forgotten. If the army had come down from Cambridge and Roxbury, the British would have been altogether destroyed; but, with the disposition of the king of England at this period, and the spirit of the ministry, the whole force of the British nation would have been brought to crush us at once. The great mistake made by them was that of undervaluing their enemies.

It is idle for us now to quarrel about each one's share of glory in the fight, where all were brave—Prescott, Putnam, Stark, Gridley, Dearborn, and all, performed their duty—and who could do more in such a case. Some complaints were made to the commander-in-chief, and several officers were arrested and tried for misconduct and cowardice. Among these, was one case which deserves particular mention. Captain Benjamin Callender commanded a company of artillery, and was seen coming from the hill without his men; in fact, finding their ammunition spent, they had retreated contrary to the captain's orders. In the excitement of the moment, the court pronounced Callender guilty of cowardice. His soul revolted at the charge, and all who knew him could not believe it true. He bore his disgrace with that moral fortitude, which is generally of a higher character than personal bravery. He instantly enlisted as a common soldier into the company he had commanded, and followed the fortunes of the war. The soldiers treated him with great respect, as did the officers of the company also, believing him to be a brave and an honourable man. It was not long before he had a chance to show the spirit that was in him. In the course of a few campaigns, Callender had an opportunity to distinguish himself; for when his commanders were dead, or had retreated, he in face of the enemy loaded and fired his piece alone, and when his ammunition failed, and the enemy advanced upon him, he mounted his piece, in order to be found a victim on it, to give the lie to his unjust sentence. The British officer who led up those about to take possession of the artillery, noticed the gallant conduct of the artillerist; prevented his men from firing on the unarmed and solitary hero, took him under his care, gave him a letter to General Washington stating the facts, and dismissed him without an exchange. The chieftain received Callender with open arms, and with tears of joy restored his commission, allowing him to take rank from its original date before the battle of Bunker's-hill. Callender remained in the army after the peace, being one of the few retained by the old congress, and he died in the service on the peace establishment. Have we not parallels for every episode of history? Of many of these we must say, as has been said in ancient times of some of the brave and good—"*they had no poet, and they died.*"

Bunker's-hill has now become con-

secrated ground; it has not only been the battle-field, but it is now publick property. Fifty years after it had drunk the blood of friends and foes, the ground was conseerated by eloquence and patriotism, and glorified by the presence of the remnants of that day—the 17th of June, 1775—beings of a former generation, who hung upon society as the leaves of those evergreens which seem to disappear without dying, only making room for new buddings and new expansions. The ravages of time make the treasures of a nation's fame. Let us garner up our notices of past ages, and preserve them in the archives of the country: we shall please and instruct ourselves by so doing, and make posterity lastingly indebted to us for the deed. To transmit the honours of one age to another is our duty; to neglect the merits of our fathers is a disgraee.

Washington, who was appointed on the 15th of June, reaehed the American camp on the 2d of July, 1775. He was anxiously looked for. The body of men eolleeted at Cambridge were fine materials for an army, but there was little military knowledge and less subordination. On the 5th of July, Washington issued his general order. It is a composition displaying good talents, though not so easy in its style as his subsequent orders. It was then, however, admired as a most wonderful produetion. The soul of the great man was seen, as it were, brooding over this military chaos, and bringing substantial and beautiful forms to light. The heights surrounding Boston were at once fortified and put in a military posture; and he showed the British what a sagacious mind could do, even if he had not waded through a field of blood. He soon perceived there was almost a total want of bayonets and munitions of war in the army. The muskets were in good eondition as fowling pieees, but there were but few bayonets, and no uniformity in ealibre. Some were king's arms, some Freneh pieees taken in the different wars, and some Dutch guns bought ages before. To supply the necessary munitions of war was a prime desideratum; and, understanding that several ships were bound to Canada, loaded with the necessary artieles, the commander-in-chief gave eommissions to several privateers to cruise against the English government ships, and capture them wherever found. This was the boldest act of this great man's life, and, like the rest, it was successful. He was soon aided by the provincial congress of Massachusetts, who also fitted out privateers this season, and formed admiralty eourts for themselves.

Before the declaration of independence, 34 valuable prizes had been taken, many of them being laden with the preeise articles which were wanted. A distinction was made between the property of the nation and of individuals; as several prizes which were owned by merchants in England were released after capture, and restored to the owners. The prudence of Washington, even more than his great talents, inspired confidenee in this sagacious people. His troops were frequently changed while within point blank shot of the enemy fortified on Bunker's-hill, and yet they did not pereeive the fact. The six-month men retired, and new recruits took their places, and all was managed with so much circumspection, that it was not discovered when the old departed, and the new eame in. He was anxious to do something this summer campaign, which could not be done without risking the safety of the town of Boston, which was a subject for mature consideration, as the war might close in an hour, and the destruction of so important a place would be severely felt.

During this period, Ticonderoga, and Crownpoint, were taken by the troops under Colonels Allen and Arnold.

In the fall, eongress had reason to believe that Sir Guy Carleton would attaek our frontier from Canada, and to give him employment at home, a plan was laid to attaek Canada. Montgomery, who was an experieneed general, and a most gallant soldier, was sent by way of Lake Champlain to invade Lower Canada. Troops were at the same time to be sent from Cambridge by way of the river Kennebeek, to meet those coming from New York, to form a junetion for the purpose of attaeking the eity of Quebeck. The command was given

by Washington, to Benedict Arnold, who was made a brigadier general. This was a most arduous campaign. The troops suffered extraordinary hardships, from hunger, cold, and sickness, but the soul of enterprise was in this hardy band of yeomen, who feared nothing but slavery. The attack was made on the city of Quebeck on the last day of the year 1775. It was carried on with daring bravery, but proved *unsuccessful.* Montgomery was slain, and Arnold wounded.

On the 4th of July, 1776, the continental congress declared the thirteen United States to be free, sovereign, and independent. As we have given quite a full and explicit account of this event in the third part of our Treasury of Knowledge, we shall here let the subject pass, with this passing remark, that it was an act of a high and important character, and if the reader will refer to that part of the work, he will find a succinct biography of all the signers of this memorable instrument.

The politicians had taken a bold step, but our armies were unsuccessful during the summer and autumn, and from every quarter gloomy accounts were received. At the close of the year, the battle of Trenton enlivened the spirits of the people, followed as it was by that of Princeton.

The world now perceived that Washington was a military chieftain of a high order. The colonists saw that the British army were numerous; twenty-five thousand men, of the flower of Europe, were now in our country, and must be driven out before American Independence could be sustained. The battle of Brandywine did not dispirit the Americans, although after hard fighting they were obliged to retreat. The battles of Germantown and Redbank were only so many lessons to teach them the art of fighting, and had the effect of rousing their spirit. In the autumn of 1777, an army was sent to stop the progress of General Burgoyne, who marched from Canada by the way of Lake Champlain, to join the British forces in New York; Ticonderoga was yielded to the British without any resistance, and the retreating army was sadly cut up. Burgoyne proceeded victoriously, until the defeat of Count Baum, at Bennington, by the New Hampshire troops, under the command of General Stark. Breyman, who came to assist Baum, was obliged to retreat to the main body. Burgoyne now made a great effort to accomplish his purpose, but the American militia flocked to the army under Gates, and on the 19th of September a spirited engagement took place, the details of which are very interesting, and have been given to the world by some of the actors in the scene which they described; Burgoyne, and the Baroness of Reidesel, are conspicuous among them. Both armies fought well; both lodged that night in their own camps; and both suffered severely. After this battle, his Indian allies deserted the British commander; this was a sad omen. The next battle was fought on the 7th of October, which terminated in the surrender of Burgoyne and his whole forces. Thus a British army, of more than ten thousand men, was forced from the field of action, and the victorious American troops were allowed to turn their attention to other quarters. This disaster aroused General Clinton to proceed up the Hudson from the city of New York, and make an attack on forts Montgomery and Clinton. These miserable works were bravely defended by Governor Clinton; but he could not resist the force brought against him.

This year articles of confederation were formed by thirteen colonies assembled in congress, and the style of the confederation was to be, the "United States of America." Every movement, after this time, became national; and France, which had hitherto delayed joining the cause of American Independence openly, now came out boldly. The national flag of the young republick was fixed upon. Congress now refused to listen to any propositions which were not based upon an acknowledgement of independence. The defeat of Burgoyne was in a short time known to all the great powers of Europe, and it was thought, on the continent, that America would succeed in her momentous struggle. Much was to be done, but all fear of her being defeated had subsided. In 1778, was fought the battle of Monmouth, remarkable for its com-

mencement and termination. Success had flitted from one standard to the other, during the day. The Americans claimed the victory as they slept on their arms in the field of battle, and the British departed that night.

In the summer of this year, a French fleet arrived to assist the United States, but was not of much service, as affairs were managed. The French monarch also sent an ambassador to this country.

The massacre at Wyoming was perpetrated at the close of this season. It was said to have been done under the command of Col. Butler, a refugee, and Brandt, a half-blooded Indian. But, within a few years, the son of Brandt has vindicated his father's memory, and proved to the satisfaction of many historians, that he was not there at the time the bloody deed was done.

In 1779, the war was carried on in the south—a desperate attack was made on Savannah, by the French, under Count D'Estaing, and the Americans, which proved unsuccessful, and with great loss of lives. In the attack, fell the Polish Count Pulaski. He was the "bravest of the brave." His life had been full of adventures. He had been at the head of a revolution in his own country, and performed prodigies of valour, but without success. His deeds have been blazoned in fiction and verse—his whole character was epick.

This year is also memorable for many other events. The Penobscot fleet, under Commodore Saltonstall, was lost. This was a sad blow to Massachusetts; at a heavy expense she had fitted out the expedition.

The six nations of Indians, who had become troublesome by their savage incursions, were chastised by General Sullivan, their country overrun, and their corn fields destroyed. The Indians, under Brandt, made several desperate attempts to avenge themselves, and did considerable injury in the neighbourhood of Albany; but their strength was wasted, and their courage gone.

About this time a settlement was commenced at Lexington, in Kentucky, which, to use the language of the red man, was "the first seed of a big tree."

In 1780, the war raged with great fury in the southern states; victory first favouring one side, and then the other, but nothing decisive was done. Baron De Kalb was slain at the battle of Camden. He was by birth a German, but had been many years in the French service, and was esteemed an intelligent and brave officer.

This year was also marked by the treachery of Arnold, and the death of Andre—events in the annals of the revolution, never to be forgotten. History and fiction have taken them in keeping, and have given every minute circumstance of the affair—Arnold is execrated—Andre loved and pitied.

1781—This year General Greene took command of the southern army; in the early part of it was fought the battle of the Cowpens, which terminated in a brilliant victory, on the part of the Americans. General Morgan and Colonel Washington gained new laurels by their gallant bearing on that day.

In all the attacks and retreats of this year, the British generals, Lords Cornwallis and Rawdon, and the American generals, Greene, Marion, and in truth every other officer intrusted with command, showed themselves worthy of their stations. The battle of Eutaw Springs, fought on the 8th of September of this year, was desperately contested, but proved successful on the part of the Americans.

On the 14th of October, two British redoubts were taken at York Town; and on the 19th of the same month, Lord Cornwallis surrendered to Washington. This victory settled the great question of the longer continuation of British power.

There were some evidences of revenge, rather than of power, after this. The traitor Arnold made a predatory excursion into Virginia, and returning to the north, burnt New London, took Fort Trumbull and Fort Griswold, and acted the part of a vindictive barbarian, whose soul all honour had deserted.

In South Carolina, the scenes of tyranny and oppression were going on. Colonel Hayne was executed by order of Lord Rawdon, which exasperated the whigs of the south,

and urged them to retaliate on every tory.

The year 1782 was memorable for the acknowledgement of American independence by the United Provinces of Holland. In addition to this, Mr. Adams negotiated with them a loan of several millions, then much wanted in the United States.

On the 14th of December, Charleston was evacuated by the British. The war was now virtually closed.

In 1783, peace revisited the weary colonies. Their independence was acknowledged by Great Britain, and by several of the great powers of Europe. Washington disbanded his army, and repairing to Annapolis, where Congress were then sitting, resigned his commission, which he had held nearly eight years, with glory to himself, and honour to his country.

The peace being established, the good and patriotick who had laboured for this momentous event, now felt great anxiety for the general welfare of the country. The pressure of war was no longer felt, but the exhaustion produced by protracted exertion was severe. In several of the states, a spirit of enterprise was discovered—Pennsylvania and Massachusetts established banks; in New York a chamber of commerce was instituted; and a show of business was made in many other places;—but still there was such a want of union of purpose and action, that a more closely connected union became indispensable. To form a government that would give concentration, energy, and dignity to the nation, was the desire and study of every thinking man in the whole community. In several of the states, symptoms of an insurrectionary spirit were seen; and in Massachusetts and New Hampshire they broke out into overt acts, but the insurgents were soon put down, and quiet, if not harmony, was restored. The national debt laid heavy upon the confederation, and they had no means of paying it off, or even the interest of it. A convention was called to form a constitution that would remedy the evils complained of, which had now become alarming—bankruptcy, civil war, and national suicide, were feared to be close at hand. This convention grew out of a proposition of Virginia to the other states. The deliberations of this body were transmitted to the people of the several states for their acceptance. After many difficulties, the system of government offered to the people was adopted; and in 1789 the new constitution went into operation. Washington was elected president, and John Adams vice-president, of the United States; both patriots, who had a strong hold on the affections of the people, for their talents, probity, and services; and their characters inspired a confidence throughout the Union, which also spread to many foreign powers, who, after receiving the inaugural address of George Washington, were prompt in making treaties with the new republick. The appointments of Washington were most judicious; great and good men were put into places of trust and importance. New life-blood was infused into the body politick, and hope and confidence filled every bosom. The wilderness was explored—institutions of learning grew up—and commerce was extended to every sea. The great publick functionaries declared that "knowledge and virtue were alone the sure basis of human happiness, and that men, to act wisely, must understand their duties and their rights." One difficulty after another vanished; and Washington retired, after two presidential terms of four years, leaving the country in prosperity.

In 1797, Mr. Adams was elevated to the office of chief magistrate. France was now in the confusion following her revolution, and she made improper demands on our country, and not being so speedily answered as she instantly required, commenced seizing American property on the high sea. Letters of marque and reprisal were issued by the government of the United States, and such was the promptitude of our marine, that peace was soon established. The frontiers on the west were vexed with Indian warfare, and often the arms of the republick were not sufficient to keep these fearful foes at a proper distance; but at length being severely

chastised by General Wayne, they sued for peace.

In 1800 the seat of government was removed from Philadelphia to Washington, a new city, which had been designated by Washington, under a law of Congress, a central situation for the representatives of the different states of the Union.

In 1801, a great change was produced in the national opinions of the people of the United States. Mr. Jefferson had been chosen to succeed Mr. Adams, and a change of men was followed by a change of measures. Mr. Jefferson was by nature and practice, a lover of peace, and struggled hard to maintain it in his time. At this period, Louisiana had been ceded by Spain to France. Up to this time, the Americans had used the port of New Orleans as one open to their commerce, which gave them facilities on the western waters. France ordered this port to be closed. Some of the American statesmen thought this sufficient cause of war, and were in favour of taking the port by force of arms; while others were for settling the whole dispute by negotiation. Mr. Jefferson was of the latter opinion, and in 1803 he purchased it for the United States, at the price of fifteen millions of dollars; but before this purchase, the port of New Orleans was open to our commerce. This was a most fortunate bargain, as it has proved, giving the country a large property for a small sum of money, comparatively speaking. The territory was speedily taken possession of, and American enterprise took the place of Spanish sluggishness.

The whole country received a new impulse, and after a few years, the most determined opposer of the purchase was silent on the policy of the measure. Mr. Jefferson pursued his course, secure of the majority of the people; but an intelligent and powerful minority was still against him, and his course of policy. One cause of objection to him was his supposed opposition to the navy—for soon after his coming to the chair, the Barbary powers showed a disposition to take advantage of our supposed want of a naval force, and made high demand of tribute. A portion of our navy was sent into the Mediterranean with instructions to protect our commerce, and to save our citizens from imprisonment; but this was not sufficient; a course more energetick was necessary to vindicate our national honour, and to secure the prosperity of our merchants. These piratical hordes had been the scourge of christendom for ages. They had made the nations of Europe tributary to them for many centuries. They had plundered merchants trafficking in the Mediterranean, and made slaves of their prisoners. They had swept the Adriatick, depredated on the coast of Spain and Italy, and in fact, at times, had the control of the whole Levant. These pirates were so chastised by our navy, that it produced in them a disposition for peace. Our naval officers acquired much glory in this war. Even his holiness the Pope, acknowledged that the young republick had done more towards repressing these pirates in a few years, than all Europe had effected for centuries. The furious Corsair was now found to be a less terrifick foe, than had been imagined. He wanted that skill which could not be supplied by a fanatical bravery.

The commerce of the United States, notwithstanding all its embarrassments, continued to flourish until 1807, when our difficulties commenced with France and England, which grew out of the English orders in council, the Berlin and Milan decrees, and the attack by the British ship Leopard upon the American frigate Chesapeake. This caused the government of the United States to lay a general embargo. This was a severe and inefficacious measure, and was with difficulty carried into effect. One irritation followed another, until, in June, 1812, war was declared by the United States against Great Britain. A great proportion of the population on the sea board were opposed to the war, and a strong protest was entered by the minority in congress against it.

The early part of the war was disastrous to the American arms. General Hull was under the necessity of surrendering his army to the British. Almost at the same time, his nephew, Captain Hull, of the navy, achieved a victory in the capture of the Guerriere, which revived

the spirits of the nation, for they had in general believed that glory was not to be gained in this contest at sea, but it happened otherwise.

This capture was soon followed by others, in which equal gallantry was evinced. Captain Jones, of the Wasp, took the Frolick; Captain Decatur took the Macedonian; and Captain Bainbridge the Java.

American privateers were fitted out, and although property was their great object, yet some very splendid actions were fought by them. The schooner Dolphin, carrying only two guns, under the command of Captain Endicott, captured a British ship of 14 guns. The war now began to wear a serious aspect. There was nothing but disappointment on the frontiers; for if now and then a brilliant action was fought, the advantage was nothing in respect of gaining territory or subduing the enemy.

The tide of war was now turning, when Perry captured the British squadron on Lake Erie. It was a victory won by skill and bravery, and was followed by humanity and courtesy. The battle of the Thames soon followed this naval victory. This action was fought with great prowess by the troops under General Harrison, and no small share of the glory fell to Col. Richard M. Johnson, who commanded a regiment of mounted volunteers from Kentucky. Generals Jackson and Coffee chastised the Creek Indians, and preserved the frontiers from massacre and plunder.

The eyes of the people were now turned to General Brown, for under his command Fort Erie was taken, and the battle of Chippewa fought, which redounded to the honour of the American arms.

The capture of the city of Washington happened in August, 1814. This was a mortifying affair on the part of the Americans, and reflected but little credit on the character of the enemy. The capitol was burnt, and all the publick buildings, except the patent office, were destroyed. This building was saved from destruction by the eloquence of Doctor Thornton, who made a feeling appeal to the commanding officer, representing to him that if he burnt that office, he would be ranked with the Goths and Vandals, or with Omar, who burnt the Alexandrian library.

The attack upon Baltimore followed: Major General Ross was slain in this enterprise, and the British retreated.

The battle, on the 25th of December, at New Orleans, was of a decisive character, but that which followed on the 8th of January, was extraordinary in all its features. It was the glorious finale of the war of 1812, a war, which, beyond all human calculation, did immense service to our national character. Those who had prophesied disaster, were disappointed. Those who had for ever traduced the navy were put down, and all parties seemed to be satisfied that they had gained something, and all were rejoiced at the return of peace.

The war had brought the nation before the world; and the fact of having broken the magick of British supremacy on the ocean, alone extended our fame far beyond what any land-fight could possibly have produced. Ages had passed since they had yielded to any thing like equal force, nor did they even think they ever should. It did so happen. If much misery was found in the train of war, as misery always walks in her train, still much was gained in the way of national honour. The President of the United States, although not a military chieftain, was a firm and decided statesman. His state papers were all written in good style, and appeared to the world as documents of great power. He always had the best of the argument, and the powers of Europe were generally on his side. It is not the first time in the history of nations, that accident has done more than calculation.

The war was closed by a treaty between Great Britain and the United States, in December, 1814; and our nation immediately set about reviving commerce, and encouraging the useful arts. The evils we had suffered from having all our workshops in Europe, and particularly in England, during this short war, induced some of the most enterprising citizens to establish factories in many parts of our country Massachusetts, Rhode Island, and Pennsylvania,

took the lead, but other states soon followed; and such was their success in getting machines to answer all the purposes intended, that it was soon seen that the fears that some really had, and others affected to have, on this subject, were entirely groundless. It had been contended that it would require a century to manufacture machinery in the United States that could be depended upon. In less than seven years after the war, some of the best machinery that ever was put in motion, was to be found in many parts of our country. The enterprising promoters of domestick manufactures had to struggle with many discouragements at first; but perseverance will ensure them success, and they will have the satisfaction of knowing that the country can at all times be independent of other nations from her own resources.

While the United States was at war with Great Britain, the dey of Algiers committed many acts of insolence and violence on the persons and property of American citizens. At the termination of the war, the government had leisure to chastise him, and lost no time in sending a squadron to the Mediterranean. Stephen Decatur, with a part of the squadron intended for this station, reached it first, and captured two of the enemy's ships in the most gallant style, which struck terrour into the heart of the dey. When Bainbridge arrived with his large force, the barbarians were disposed to make peace on fair terms. This arrangement he afterwards attempted to get rid of, but was obliged to keep it.

In 1817, Mr. Madison had retired from office, and Mr. Monroe was elected president of the United States. Mr. Madison was an able statesman, and managed the affairs of the nation with great ability, considering all the difficulties he had to contend with. We had to fight the most powerful nation on earth, without any preparation for war. We had to turn our ploughshares into swords, and our pruning-hooks into spears.

The administration of Mr. Monroe was one of peace and prosperity. The Floridas were ceded to the U. States by treaty, in his administration; perhaps the most important negotiation since the purchase of Louisiana, in which transaction he had no small share. Mr. Monroe had been a publick man from earliest manhood, and had filled more important offices than any other person in the United States. In his administration the whole machinery of government moved on harmoniously. In every part of the country the marks and the proofs of prosperity were visible. Not only did the arts and sciences flourish, but institutions of charity and piety were established throughout the land. During his administration, La Fayette was invited to this country, and went through it, receiving all the honours that a grateful people could bestow. This was not all—to show that republicks are not always ungrateful, congress gave him 200,000 dollars, and a grant of land in the Floridas worth much more.

In 1825, John Q. Adams was made president of the United States. He had been secretary of state under Mr. Monroe, and at all times possessed his confidence, consequently there was no change of measures. His inaugural address was filled with respect for his predecessor, and he declared he should tread in his path. He did so. His talents were considered of the highest order, and his education superiour to that of any other statesman in the country. He held his office only one presidential term, when he was succeeded by General Jackson, who had acquired unbounded popularity by his astonishing defence of New Orleans. The General is now serving a second term, and has lately acquired great popularity among those who have heretofore opposed him and his politicks, as well as among his old friends, by his able exposition of the constitution of the United States, in his proclamation issued in consequence of the proceedings of the legislature of South Carolina.

A SKETCH OF THE HISTORY OF THE ARTS.

The arts and sciences are in some way connected with all the powers and faculties of the human mind; and it is impossible to improve in a knowledge of the former, without enlarging and strengthening the latter.

Popular and useful science now includes what was once recondite and mysterious. What philosophers once looked grave upon, is now familiar to children as household words. It requires constant labour to keep pace with the knowledge of the times. No hours should be lost —*time is short and science long*—the day has arrived when no narrow view of things will answer.

To show how necessary the arts and sciences are, in bettering the condition and elevating the mind of man, we need only to glance at the origin of the arts. They had their birth in the early ages of time. The first exertions of man must have been directed to sustain his life, to make instruments to kill game, to snare the bird, and hook the fish ; and then to form those weapons of self-defence, which have been common to all nations that have been found in savage life. The next art they learned, was one of necessity in a second degree—to dress and prepare the skins of the animals they slew, for clothing and ornament. The next was of a higher order, and required more patience and ingenuity to perform—the bark of trees was pulled apart and put together in new forms, without much machinery but the human hand, which transcends all other machines that ever were created. Spinning and weaving followed. These arose from a love of dress, planted, no doubt, in the human mind for the best of purposes. The dames of the east saw the pods of the cotton plant bursting out with a flower of snowy whiteness, and on taking it into their hands, they found it delicate to the touch, and susceptible of the most wonderful attenuation. Long reflection, and repeated attempts, at length brought it to a thread, and from that to a cloth. So it was with the flax, which grew spontaneously on the banks of the Euphrates and the Nile; they found the fine hearl remaining when the other part had decayed, and, twisting it in their fingers, made from it an excellent thread for various purposes in household affairs. One generation improved upon another, as the mother instructed the daughter in successive ages, until all were astonished at the degree of perfection to which the art of making cloth was brought ; and they then ascribed the origin of it to some female divinity. The Egyptians gave the credit of the invention to Isis, the Grecians to Minerva, and the Peruvians to the wife of one of the Incas.

The progress of the art of building must at first have been slow, for in the region which was first inhabited, very substantial houses were not required to shelter their inmates. The probable advancement was owing to human pride or religious feeling. The hither and farthest east are marked with pyramids, built before the records which are in existence had commenced. The traveller, George Bethune English, counted in Eastern Abyssinia more than two hundred pyramids, from eighty to one hundred and fifty and two hundred feet in height, which had probably not been seen by any European since the days of Thales. These he considered only as tombstones to the mighty dead of past ages. Some tender-hearted historians have mourned over these vast piles, and imagined the tears and groans of the countless millions who were tasked in their erection. I do not join their lamentations, for it appears to me that these masses were erected not only to gratify pride, but to promote peace. These nations were inclined to cruel wars ; and a wise prince often engaged the minds of his people in some national affair, as erecting a temple, building a city, or cutting a canal, to quiet the restless minds of his subjects. David could not build a temple, for he was always at war ; but Solomon had peace and leisure, and engaged his people in an undertaking which gratified their national pride.

In this early period, every one who did any thing to advance the arts was paid by extensive renown, and not unfrequently by divine honours. The beautiful fable of the ancients, of Vulcan and his wife, of his forging thunder bolts for his father Jove, was probably nothing more than this :—Some ingenious smith, having made better tempered swords, and more curious shields, than had been in use before, received for his reward from his liege lord, every honour, and with them the hand of his most lovely daughter in marriage ; and this Vulcan gave her as a bridal present that wonderful girdle, so exqui-

sitely wrought, by this worker in all metals, since known in every poetick legend as the Cestus of Venus. The ingenuity of the poet was equal at least to that of the artist, and he has described it in transcendent verse.

"In it lives every art and every charm
To win the wisest, and the coldest warm—
Fond love, the gentle vow, the gay desire,
The kind deceit, the still reviving fire,
Persuasive speech, and more persuasive sighs,
Silence that speak, and eloquence of eyes.

The story of the forge of Vulcan being under Mount Etna is clearly accounted for, by the fact that every artist at that time worked secretly, so that no one should steal his information. The great smith no doubt had his shop in some retired spot, near the mine he was drawing from; and his athletick journeymen and apprentices, with their sinewy arms and ponderous blows, seen and heard by wood cutters and shepherds through masses of smoke, were magnified to Cyclops in their imagination.

In the ages before letters were invented, the arts unquestionably had made some considerable progress; but they could not have reached a very high state of perfection, until one generation were possessed of the signs by which they could communicate their thoughts to another. The hieroglyphicks on Babylonish bricks, are now found to have sounds attached to them, and are, therefore, as much letters as our own alphabet, so that in the days when the Pyramids were erected, letters were known. If written language was not so copious then as at the present day, still it was surely a medium of communication.

Passing from Egypt to Greece, the use of letters was improved, and the arts were refined, and several of them reached perhaps their highest point of perfection. The architecture and sculpture of that day have never been surpassed, if equalled—it was the reign of taste and genius. The talents of the Greeks were not confined to the fine arts alone;—their weapons of war were much better than those of their neighbours. If they did not know how to make steel, they mixed copper and other metallick substances with their iron, to render it tougher than iron could be made alone, and the superiority of their weapons was found in every war they had with the Persians Their architecture has never been surpassed. No man could speak coarsely who had taste sufficient to admire the Parthenon; and the mind of Greece had stamped itself on every particle of manufactured matter in Attica. In the bosom of the arts man could not be a savage. In all the progress of their arts, the professors of them did homage to the poet, for they not only made the semblance of men after the conception of Homer, but modelled the images of the gods after his description of them in the Iliad.

At the same time that the arts and letters were flourishing in Greece, perhaps previously, commerce had scattered them over many parts of the world. They had made great progress at Jerusalem, and among the Phœnicians and Tyrians. Solomon sent to King Hiram for an accomplished artist, and one was sent of a high order.

"*Now I have sent a cunning man, endowed with understanding, of Hiram my father's, the son of a woman of the daughter of Dan, and his father was a man of Tyre, skilful to work in gold, and in silver, and in brass, in iron and in stone, and in timber, in purple, in blue, and in fine linen, and in crimson; also to grave any manner of graving, and to find out every device which shall be put to him, with thy cunning men, and with the cunning men of my lord David thy father.*"

This is not only a proof of the advancement of the arts, but of the high estimation in which mechanicks were held by the princes of those days. Here was an ingenious son of a widow, extolled by one monarch, and received by another as a friend and brother. The arts, in this instance, were made subservient to piety, as well as to taste and to peace.

The work of Solomon and his artist, the widow's son, is a proof that the arts were in a high state of perfection. If the temple was equal in wonderful workmanship to the Parthenon, it wanted something of the classical taste of the latter. The gorgeous style of Oriental affluence was more regarded by the wise man of Judah than by the architects of Athens.

The Romans borrowed their arts

from Greece; they invented but few things themselves, but were content with what their masters in the arts had produced for them. If they improved in any thing, it was in the use of the mechanical powers, as applied to the battering-ram, and in the art of tempering swords. Their swords were better than those of the nations they contended with. When they fought with the Gauls, they found men as brave as themselves; but the swords of the Gauls were untempered, with a bad cutting edge, and were easily bent in fighting, which rendered them useless until they were straightened, and for this they had no other method than pressing them under their feet.

When Greece was no longer free, and the power of Rome had declined and was tottering towards a fall, then letters were neglected, and the arts ceased to flourish;—then the stern conquerors regarded no arts but those of furious warfare;—food, power, and conquest, were all their wants, and all they sought;—in the halls of the conscript fathers they hunted wild beasts for amusement. With the arts sunk the dignity of man and the courtesies of life. The pride of refinement and of science was no more; but brute force took the reins of government and directed the course of nations.

The arts and sciences were crushed—not destroyed. A chosen few preserved them most sacredly, but they were mixed up with superstitions and mysteries;—then, art and mystery were synonymous; and numerous oaths were necessary to get initiated into any art or science. The building of castles and churches was confined to a few only—that is, a few who knew the plan or intention of the master-builder. That these were faithful workmen, is in evidence when we examine Westminster Abbey, or any of the old churches, from St. Sophia downward. They were made upon the most desirable principles. In the dark ages, the mind had an influence upon the arts, and the arts upon the mind and taste. It would have been quite impossible for the monks to have performed all their rites and ceremonies of flagellation or starving in a fine Grecian temple. They must have had *deep solitudes* and *awful cells* to have brought the mind to such a gloomy discipline;—Gothick gloom and grandeur were necessary to bring the spirit to such cloistered feelings. The learned men of that day were sagacious; they knew that the mind of man, in some degree, resembled the skin of the chameleon—it takes a hue from external matter, from light or shade.

There were some bright spots on the globe in the ages of general darkness—some sweet moments in the passage of time. Arabick literature and science flourished in the ninth century. The house of wisdom was illumined with ten thousand lamps of science, that were suspended to imitate the clear skies and splendid climate of Greece, in the days of her orators and poets. The Arabians had more enthusiasm, if less taste, than the teachers of the world; and in some arts and sciences they surpassed their masters. The first clock that ever measured time was made for the caliph of Bagdad. This art, it has been said, was lost for several centuries. But the successors of that race of men did not forget the discovery of an art of a pernicious nature. The Arabs found out the art of distillation, and exhibited alcohol as a triumph of art, in making nature give up her secrets to those who severally interrogated her; and every rude nation since has kept possession of that secret, until it is no longer one. They have steeped their senses in the alcohol, but found in it none of that inspiration which breathed in the learning of the age and nation whose glories we are glancing at.

Events that seem to astound and afflict mankind at the time they occur, are often made causes of the happiest results. When the Turk came down upon Constantinople, in 1453, all Christendom trembled for the fate of the cross. The political seer beheld in his affrighted visions another Omar demolishing thousands of Christian temples, and erecting mosques in their stead, throughout the world. But these fears were not well grounded. By this event the knowledge which the Greeks still possessed was scattered throughout all Europe. The learned men, who had been dozing at the feet of imbecile tyrants, and wasting the glimmering light of their minds upon de-

cayed institutions, were now driven abroad by the wreck of the eastern empire, and acquired new life by breathing freely the open air of Europe. Letters, it is true, took the first place, but attention to the arts and sciences soon followed.

At this crisis was discovered the most important art that the world has ever known, the invention of printing. Now commenced a union between letters and the arts, that time can never dissolve. It was the bow set in the moral world, by which the Creator declared that the floods of ignorance shall never again deluge mankind. This was indeed the art that harmonized the world, and placed within the grasp of each person, the knowledge of all, for their contemplation and advantage. In a few years after this wonderful invention, the whole of Europe was well supplied with books of value in the different languages, and in the arts and sciences.

Now the enterprising portion of Europe seemed alive with their ambitious pursuits of knowledge:—Florence, Venice, Portugal and Spain, with France and England, turned their attention to cultivating science as well as letters; and soon after this period, Rome, which for so long a time *had believed and slept*, now became alive to painting, architecture, and all the fine arts. In less than half a century after the fall of Constantinople, Columbus had discovered a new world, and Vasco de Gama had found a passage to India by doubling the Cape of Good Hope. Not far from the close of the fifteenth century, the Florentine muses had gained an enviable renown; and Michael Angelo, in the pride of art and science, had declared that he would place the Pantheon in the heavens; and the size of the dome of St. Peter is precisely that of the temple of the gods.

All this would not have given to Europe this Continent, if another art had not been discovered—that of making gunpowder. If the aborigines had been put upon equal grounds with the assailants in regard to weapons, we should not have been here at this day, for sufficient corporeal strength could not have been brought to subdue the natives.

The invention of gunpowder seemed at first to threaten the extermination of the human race; but in process of time, it has been found to have diminished the effusion of human blood. Well might affrighted nations have believed, when they saw the fire flash, the burst of infernal smoke, heard the thunder roll, and witnessed the havock made by the iron messengers of death, that men were soon to be driven from the face of the earth; but it did not so turn out; for the carnage of the battles of Salamis and Lepanto, were thrice as bloody as those of Camperdown, the Nile, Trafalgar and Navarino. The forms of fighting have changed since the introduction of cannon; and the use of the musket has taken off that fury which seizes men who are struggling hand to hand in mortal combat. The fight is now decided by warlike ardour, without individual vengeance. The time is probably near at hand, when art is to proceed much farther in the science of destruction:—The discovery of firing bombs horizontally will unquestionably make a most wonderful change in sea-fight; and this with torpedoes and Greek fire, may soon be in use. Invention is at work, and genius is revolving upon mighty matters in the way of warfare, as well as upon those necessary in the common business of life.

The settlement of this Continent, to use the language of a great statesman, "offered a world of matter for a world of mind." It gave a new spring to industry and to the arts. The art of ship building made more rapid progress, from the voyages of Columbus to the fitting out of the invincible Armada, (from 1492 to 1588, ninety-six years), than it had from the siege of Troy up to the days of Columbus. Cicero speaks of a ship of fifty tuns burden as a splendid affair.

The science of mathematicks was now rapidly gaining ground; and men of science, who formerly only made use of their knowledge to astonish the ignorant, now began to bring it to practical uses, in the arts of life. In 1610, decimal arithmetick was discovered, and in four years afterwards logarithms were invented; of course navigation had

acquired an accuracy that it had not previously possessed.

At the period of settling North America, navigators were not at a loss to find their course to any point on this continent. The errour made by the Dutch navigator, who brought out the pilgrims, was no doubt a wilful one. He knew better.

I will now attempt to tracc the progress of the arts in this country. The guides I have to assist me to do this are indeed scanty, and are scattered through many volumes, where such matters are only incidentally mentioned. Therc is but onc statistical work extant that was published in this country previous to the revolution, and this cannot be fully relied upon. I mean Douglass's History of New England.

The settlers of Virginia brought mechanicks capable only of erecting a house or small fort, or constructing a boat. The first object of the settlers was quite indefinite; and trading with the Indians, raising tobacco and corn, constituted their principal pursuits. Thc ruins of Jamestown discovered no marks of advancement in architecture. They have trusted more, in every stage of their growth, to agriculture than to the arts.

The emigrants which came to other parts of this country, soon after the settlement of Virginia, were, to all intents, at first, a mere trading community, and thought but little of the arts. The mother country furnished all articles they wanted at a much cheaper rate than they could manufacture them here.

The settlement of the pilgrims in 1620, afforded no more mechanicks than were absolutely necessary for the emergencies of the hour:—they came with no other settled purpose than to worship God in their own way. The first buildings they erected at Plymouth, exhibited no marks of taste in the arts. It was reservcd for those intelligent colonists who settled the Province of Massachusetts Bay, and who first came to Boston, to be the founders of the mechanick arts in this country. They early began ship-building, and of course encouraged all the mechanicks connected with this business, such as carpenters, anchor-makers, smiths of almost every description sail-makers, riggers, calkers and gravers, block-makers, &c. Such was their enterprise in this art, that, in 1665, there were one hundred and twenty vessels, from twenty to one hundred tuns, in Massachusetts, and twelve ships of a much larger size. From this time, up to the period of the revolution, many vessels were built for English agents, in New England. On every well situated stream, the business of building vessels was going on, as the lumber and labour was reasonable, and a vesscl was soon ready to launch after her keel was laid. Thesc vessels were fastencd with trunnels of wood, and much iron was not wanted; whatever was required was brought from England. The men engaged in ship-building had always a powerful influence in the sea-port towns of this country, and they werc particularly forward in those stormy times preceding the revolution. Caucuses were first held by them in Boston, and they were the pioneers in every act of opposition.

The art of printing was almost coeval with that of ship-building in this country. A press was cstablished in 1639, at Cambridge, near Boston, and the art has never flagged since. Works of utility, such as the Freeman's Oath, and those opening or explaining the duties of men who loved liberty, were first issued from this press, and then works of piety and sentiment. The history of the press in this country, would of itself make a volume.

The next branch of industry and the arts, was that of making iron; the want of which was greatly felt. In 1645, only fifteen years after the scttlement of Boston, the legislature granted leave to certain petitioners to build a forge at Lynn, within ten miles of Boston. The forge was erected, and did well; but some misunderstanding taking place, it was abandoned. The first iron ever made in the colonies was at this forge. Thc same year, the general Court offered a bounty, and were willing to grant a monopoly for making iron, and did actually appropriate 3,000 acres of land, as an inducement to establish a forge. They indeed went farther, and offered the extraordinary grant of exclusive possession of the territory for three

miles square near the forge, as the domains of the establishment, and that the number of these exclusive grants might be extended to six. In 1652, seven years after this offer, a forge was set up at Raynham, about twenty miles south of Boston, which flourished for some time. More than sixty years after this period, (1715,) pig iron was made in Virginia.

As early as 1659, an attempt was made in Virginia to manufacture silk. An act passed the legislature of that commonwealth for encouraging the manufacture of this article, with an intent for making it a staple for export; but tobacco and wheat were found more productive, and took the place of all other commodities.

In 1703, the business of making silk was introduced into South Carolina, probably by the Huguenots, who fled to this country at the revocation of the edict of Nantz, and it flourished for a while; but it happened, that eight years before this period, (1695) rice was brought there by a vessel from Madagascar, the master of which distributed a bag of rice, and instructed the people in what sorts of soil to sow it. The crop was satisfactory, and this and indigo were the staple articles of export from that state, till in a later age, they were superseded by cotton.

In 1759, Georgia made considerable progress in manufacturing silk; 10,000 pounds were brought that year to Savannah for market. Other crops, however, soon took the place of silk.

After the revolutionary war, there was a successful attempt to manufacture silk in Connecticut; and in 1792, a clergyman's gown, and some silk stockings, were manufactured in that state. In many places this article of late has been attended to; and the yeomen of the country are planting mulberry trees, in order to commence the cultivation of silk on a large scale.

Cotton, now the great staple of the south, was introduced into South Carolina about the middle of the last century. In 1788 it was first planted in Georgia. In 1791, it was first exported from this country.—The same year, a cotton factory was established at Rhode Island, the first, I believe, in the United States. In 1830, 613,185 bales were sent from the United States, and the amount is increasing every year.

Flax was not cultivated for domestick manufacture until 1719, when the Irish settled Londonderry, in New Hampshire. They brought with them the foot-wheel, and began the liberal culture of the flax;—they also brought with them the Irish potato, which, until then, had not been cultivated in New England. The Spanish potato was not introduced until 1764. Soon after this, no inconsiderable quantity of flax was raised; for it was a long time before cotton was brought from the south to New England. The shirts of our fathers were for many years made of woollen: one reason, perhaps, why they had fewer cramps than we are subject to.

Among our early manufactures, were hats of an excellent quality, which were made for exportation. We had plenty of beaver and otter, and made them in a most durable manner. This article was particularly searched for by the custom-house officers, after the navigation act went into effect; but the act was avoided by sending the hat-bodies to the West India Islands, and with them mechanicks as finishers, by which means no inconsiderable trade was carried on. Other articles were managed in the like manner.

It is a fact worth recording, that every attempt of the mother country to retard the growth of manufactures in this country, has eventuated in their advancement. The first attack upon the arts, manufactures, and commerce of this country, was the famous navigation act, passed by the parliament in 1651; in less than two years after the beheading of Charles I., and confirmed and enlarged by Charles II., in 1660. If this act had been rigidly carried into effect, nearly the whole commerce and manufacturing interests of the colonies would have been destroyed. But its enactments were avoided, even by the most conscientious. The custom-houses were not strict, for fear of consequences; for every wise minister of England knew how much the colonies were taxed for carrying on the war with

the French, through the medium of this country. A century passed from the time of Charles II., before England was so unwise as to look more strictly after the customs in this country.

In 1761, the first of the troubles commenced, by drawing too close the cords of the revenue system. The ordinary methods were found not sufficient to prevent smuggling; and the revenue officers in Massachusetts petitioned the Supreme Court of that State for writs of assistance, a process which had been known only to the star-chamber, empowering the officers to break into and enter any dwelling house, as well as store, in search of goods that had not paid duties. This was boldly resisted, and never was granted by the Court.

In 1765, the sugar act was passed. In the same year, came the stamp act. The effect of this was terrible. The colonies denounced it as a death blow to their liberties; and it was resisted in almost every city and town in America. The people entered into agreements not to import the necessary articles of common use from England, and did every thing they could to encourage domestick manufactures. The highest classes came into these agreements most readily, and much was done. The class of students that graduated at Harvard in 1770, appeared in black cloth of domestick manufacture.

An impulse was thus given to domestick industry, and for a while they got on by the warmth of their patriotism, yet the trial was severe. The colonies suffered less for leather than for any other article; for, having sufficient bark at hand, and not much skill being required in the manufacture of the article, they had tanned all the hides produced since the first settlement of the country.

The state of some of the arts, at the breaking out of the war, was, in many respects, at a very low ebb—particularly in those necessary to prepare us for the contest. In ship-building we astonished our enemies, by the size and number of our privateers; but in many instances they went to sea not half furnished with munitions of war, trusting to get their supplies from the enemy; and this they often effected. In June, 1775, there was not a powder-mill in the country. This circumstance put in requisition the whole of the science we had in chymistry, in order to get at a knowledge of making gunpowder. This it took some time to effect.

The first two months that Washington commanded the army at Cambridge, there was not sufficient powder in camp to last for half an hour, should he have engaged the enemy. His camp was frequently supplied with this article from our privateers, which, being commanded by brave men, generally were successful. At that period we had not a sufficient number of gunsmiths to repair the old small arms, which had been used against Indians, deer, and wild-fowl, and now wanted a little tinkering to meet the well armed foe; but mechanical ingenuity, among those who were obliged to turn their hands to almost every thing, soon remedied the most alarming evils, and at the battle of Trenton, clothes and provisions were more wanted than arms. Among those captured, there were many mechanicks, and most of them deserted, finding good encouragement among the captors. After the capture of Burgoyne, artisans had become more plentiful; yet to the close of the war there was hardly a regiment that had muskets of an equal calibre.

The country, at the peace of 1783, would have rubbed along with their manufactures, if a flood of necessary articles had not been poured in upon us, at much lower rates than we could afford to make them for, and of a much finer fabrick than we had learned to manufacture. The little factories, of course, all fell to the ground; and nothing, but here and there a blacksmith's shop, with a few fulling-mills and dressing shops, was found. The saw, and the corn mills, stood as before; these had been necessary for the very existence of the people, and they could not be dispensed with on any change of times.—The agriculturist and the merchant now had the whole field, and grew rich very rapidly, particularly from 1793 to 1806, when we had much of the carrying trade of Europe, then involved in war. After 1806, commerce began to find numerous embarrassments from the Berlin and Milan decrees, and the orders in council; and their embargoes and

non-importation laws followed.—Some capitalists began now to think of investing their funds in manufacturing establishments; but this was hazardous, for a change of times might destroy their prospects at once. England did not believe that any state of things could transfer her work-shops to America; and so firm was she in the opinion, that she laughed at the suggestion. The war of 1812, unfortunate as it might have been deemed by those who opposed it, was necessary to an independence in arts, as well as politicks. This war led some of our most sagacious men to deep reflection on the subject; and the result was to raise a manufacturing interest in our country. It was no hasty business.—They counted our wants, and calculated how they might be supplied at home. They began at the foundation, by making machinery, not thinking it would do even to import that: when the machinery was ready, it was set in motion, and was found to answer every purpose. The people took hold in earnest; and if these establishments have had their dark hours, they have generally survived every difficulty, and are now prosperous. Some have complained of the protection that has been given to manufacturing interests; but the merchant who now complains, will probably in the end be satisfied that it was a judicious policy: and the farmer is already satisfied that a home market is more certain than a foreign one.

There should be no fears entertained that mechanicks will increase too rapidly in this country. As yet we have not reached the point of a wholesome proportion to the agricultural interest. The best political economists agree in this, that one hundred agricultural families ought to support with food sixty-six families, viz.: 1 priest, 2 lawyers, 4 medical men, 4 schoolmasters, 6 tailors, 8 carpenters, 5 smiths, 3 braziers, 2 cabinet-makers, 14 manufacturers, and 12 traders, including clerks. In England, there are double that proportion, which is undoubtedly the cause of the frequent difficulties in the manufacturing cities, because there is not food enough in the country for the support of the whole: and when the mechanick is out of employment, he has no productive resources left.

Other nations of Europe are encouraging the arts and sciences, and lending all their strength, in these times of peace, to build up their manufacturing establishments. Italy now has 100 agricultural families to 31 non-agricultural; France, to 100 agricultural families has 50 non-agricultural;—Germany is enlarging her factories; and every nation that pursues such a course of policy, is securing her independence.

In former times, the prosperity of nations was estimated by the quantity of the precious metals they could command, or the flocks and herds they possessed; but at the present day, the prosperity and wealth of a nation is estimated by the quantity of iron they use;—it is a representative of their enterprise, and of the extent of their industry.

In England there are 278 furnaces in blast, which make 700,000 tuns of pig iron; which produces 545,000 tuns of bar iron: about 150,000 tuns of this is exported, and the balance, 395,000 tuns, is wrought in the country. This is indeed a prodigious quantity. In the United States, there is used over 200,000 tuns of different kinds of iron; about one half of this is imported, and the other half made in this country. Of course there is a fair opportunity for additional furnaces, without being able to supply the market. The use of iron for cables, rail-roads, fences, &c., will continue the increase of the demand, as the population increases. A few years ago, we were not apprised of the extent of our own mines, in the numerous classes of minerals. The enterprise and science of the age has made Plutus give up his buried treasure. Of the forty-three metals known now to the artist and the chymist, our country furnishes more than one half of the number, and the most valuable of them—iron, lead, copper, &c., in the greatest abundance. Every day is producing something to add to the comforts of man, and of course to the value of human life. Steamboats and rail-roads have diminished space and shortened time, and allowed us to crowd the labours of a week into the compass of a day. We have now just begun the march

of improvement in the arts, and are becoming acquainted with the laws of nature, and the riches of the earth. It is not more than eighty years ago, our statesmen and political economists saw, or thought they saw, an impediment to the growth of the country, particularly the northern parts of it, in the scarcity of fuel, and legislative aid was invoked to make the yeomen plant trees, to ward off the evil. Others, less timid, anticipated the discovery of coal; but they were thought too credulous.

We live in a world of mutations, and ever changing opinions. It is now short of six hundred years since coal was first introduced as fuel, and Edward the First, prohibited the use of it in London, from the belief that the smoke filled the air with pestilential vapours; when at the present day the same smoke is considered as destroying the pestilence.—Some mechanicks are apprehensive that labour saving machines are to be of great injury to the mass of labourers; but I think that we have nothing to fear from this quarter. In the year 1776, Mr. Hargrave, in England, invented the first spinning-jenny, which has saved countless millions to the nation; and, as far as I am able to learn, has not diminished the price of labour, the only change being in the duties of the workmen. Whatever the operatives may have to fear in England, cannot affect them in this country, while there is such a supply of land for the agriculturist; nor can we tremble at the number of steam engines, considered as consumers of fuel, as the poor do in England, seeing there are 15,000 of them at work in the United Kingdom. Our water power, scattered over the land at convenient distances, precludes the necessity of multiplying these engines in this country to any great extent.

It requires a long time to bring any art or science to a degree of perfection; and although we began with a greater share of intelligence, and more liberal means, than other nations have done, still we have not dedicated to the arts a sufficient number of years, to do ourselves justice as citizens; but every annual exhibition of manufactures shows that mind is increasing its power over matter, and that science is supplying for us what long experience had taught others. No people on earth have so much inventive genius at work, as we have, considering the number of those engaged in the arts. Mind is brought in collision with mind, and sparks of celestial fire are constantly flying abroad. The patent office, although containing some rubbish, as might be expected, is an unquestionable proof, to use the language of a distinguished foreigner, of "a deep thinking people."

A BRIEF HISTORY OF AMERICAN LITERATURE.

American Literature seems to be but imperfectly understood abroad—but when the subject is fully examined it will be found that there have been many excellent writers in this country on many subjects of deep interest to the community. Literature had been cherished in England for the best part of a century before the American colonies were planted, or before they arrived to any consideration, and the planters had no small share of it, especially that part of learning which related to theology and biblical criticism.—The puritan divines were deeply read in the humanities, and when the yoke of Rome was thrown off, they prepared themselves to defend their opinions with all the learning of the East. When these men, and those under their clerical guidance, came to this country, they brought all the books necessary to defend themselves, and the faith they professed, and instruct succeeding generations. Those who did come to this new world for conscience's sake, were among the most enterprising men of the mother country. In 1606, the Virginia settlement began. The next was commenced by the Dutch, on Hudson's river. Smith, the leader of the Virginian colony, was a man of high acquirements and accomplishments. He wrote a minute account of all he saw and examined, and of course must be considered as having commenced the literature of the country. He published, in 1608, his sixth voyage to Virginia; six years afterwards, his first voyage to New-England; and the next year, his second voyage to the same place; and in 1617, a description of the country

These were in addition to works he had previously published of his adventures in other countries.

Among the pilgrims who came to Plymouth in 1620, there were many men of literary information. The venerable Brewster, and his friend Carver, were both well educated, and the political compact drawn up before these pilgrims landed, is sufficient proof of their intelligence; and the correspondence this little band had with the settlers of New Amsterdam, only seven years after they had taken possession of New England, is corroborative of the fact. The letters from Governour Winslow to the governour of New Amsterdam are written with acuteness and elegance.—Several of his productions have come down to us and are much esteemed at the present time. One of his works is called *Good News from New England.*

The colony established by Winthrop, and others, in Massachusetts, in 1630, contained several very learned men, both in law and divinity.—Winthrop was an intelligent lawyer. He kept a journal of his proceedings, and noted all the remarkable events as they happened. This work, after a variety of fortunes, has been given to the publick, nearly or quite complete. Parts of the manuscript had been lost, which a few years since were accidentally found.

Harvard College was established in 1636, and soon afterwards a printing press was set up in Cambridge. From this press issued many valuable works. The first book printed was the Freeman's Call; soon after this, an almanack; and the first political pamphlet was "The Christian Commonwealth," written by Elliot, *the apostle to the Indians*, who soon afterwards learned the language of the aborigines, and translated the Bible into their vernacular tongue, with parcels of several other books for religious instruction. This translation of the Bible must have been a work of prodigious labour.—There are a few copies of it now extant, and these are indeed great curiosities, for the very race it was meant to instruct have vanished from the face of the earth.

Hooker, a divine who came to Boston, wrote many sermons, and a work on church discipline; and at the same period, Thomas Parker, a learned man, was engaged in the cause of literature, with James Noyes, his friend; they were publishers of several works on divinity. Some of Parker's works were on the controversial side.

Mr. Thomas Shephard wrote on metaphysical subjects; such as "*the morality of the Sabbath;*" "*New England's lamentation for Old England's Errours;*" and likewise, "*An explanation of the parable of the ten Virgins.*" This last work is said to abound in the philosophy of the heart, and has been the guide to many who have attempted an analysis of the affections and the passions. When Shephard died, President Oakes delivered a eulogy, in Latin, on his character. Shephard had two sons, who were distinguished scholars.

One of the best writers of that day, was Nathaniel Ward. He was not only a man of versatile genius, but he had laboured in several professions, certainly in law and divinity. He wielded the pen of an accomplished satirist. He wrote "*the simple cobbler of Agawam.*" This was a satire upon the enemies of Charles I., and was full of causticity and wit. He also wrote the "*Body of the Liberties.*" This is a singular work, and perhaps contains more germs of the true and fundamental doctrines of liberty and law, than any work of its size in the world. There is not a feature of all our State and of our federal constitutions, but may be found in the "*Body of the Liberties.*"

Peter Buckeley wrote Latin poetry; some scraps have been preserved. He wrote and published a celebrated theological work, entitled, "*The Covenant of Grace opened.*"

Ezekiel Rogers, a clergyman of Rowley, preached the election sermon in 1643. This production was a most direct promulgation of democracy, as he advocated rotation in office, and urged the impropriety of choosing a governour for a second term. The people were then too wise to follow such advice; but it shows how much the whole mass were inclined to democracy, that such a sermon should have been tolerated.

One of the most voluminous writers of that day, was John Cot-

ton, mostly on subjects of divinity or church government. A catalogue of his works are given, merely to show how indefatigable the founders of our Republick were in all their duties of enlightening the minds of the people: "God's Promise to his Plantation, an election sermon, 1634; a Letter in answer to objections made against the New England Churches, with the questions proposed to such as are admitted to Church Fellowship, 1641; The Way of Life, 4to; God's mercy mixed with his Justice; an Abstract of the Laws of New England, 1641, and a second edition 1655;" this abstract of such laws of the Jews, as were supposed to be of perpetual obligation, was drawn up in 1636, when Vane was governour, though it was never accepted; it is preserved in volume 5, of his historical collections of Massachusetts: "the Church's Resurrection, on the fifth and sixth verses of Revelation xx. 1642 a Modest and Clear Answer to Mr. Ball's discourse on set forms of Prayer; Exposition of Revelation xvi.; the True Constitution of a particular visible church, 1643; the Keys of the Kingdom of Heaven, and power thereof, 1644; the Doctrine of the Church, to which is committed the Keys of the Kingdom of Heaven; the Covenant of God's Free Grace most sweetly unfolded, to which is added, a profession of faith, by Mr. Davenport, 1645—3d edition, 1671; the Way of the Churches of Christ in New England, or the Way of the Churches walking in brotherly equality, &c.; the pouring out of the Seven Vials; the Controversy concerning liberty of Conscience truly stated, 1646; a Treatise, showing that the Singing of Psalms is a good Gospel Ordinance, 1647; the Grounds and Ends of the Baptism of the Children of the Faithful, 1647; a Letter to Mr. Williams; the Bloody Tenet washed, and made white, by the Blood of the Lamb, being discussed and discharged of blood guiltiness by Just Defence, in answer to Mr. Williams, to which is added, a reply to Mr. Williams, answer to Mr. Cotton's letter, 1647; Questions propounded to him by the teaching elders, with his answer to each question; the Way of Congregational Churches cleared in two treatises, against Mr. Baylie and Mr. Rutherford, 1648; of the Holiness of Church Members, proving that visible saints are the matter of the church, 1650; Christ the fountain of Life, 1651; a brief exposition of Ecclesiastes, 1654; his censure of the way of Mr. Hambden of Kent, 1656; Sermons on the first epistle of John, folio; a Discourse on things indifferent, proving, that no church governours have power to impose indifferent things upon the consciences of men; Exposition of Canticles; Milk for Babes; a Catechism; Meat for Strong Men; a Discourse about civil government in a plantation, whose design is religion." The foregoing works were probably all printed at the Cambridge press. We had made a catalogue of the works of this distinguished, early writer, but after considerable research, found one far better made at our hands, by that learned, pious, and indefatigable biographer, Doctor Allen. Every scholar in that age wrote poetry; for they called all their productions poetry, that had been twisted out of the ordinary connexion of common prose;—but at this period, they had no good models of English versification, but Spenser; and they did not relish his use of antiquated words: however, there were some who had the soul of poetry in them.

Anne Bradstreet, who wrote a volume of poems, which were printed as early as 1642, was formed by nature for a poet. She was the wife and daughter of a governour, and was well educated. Her works were historical, metaphysical, and pious; she was as much praised in that day as any of the favourites of the muses are in our times by kind friends: and she had no fear of critieks, for all the satire was reserved for polemick divinity in that day.

Hooker, who came to this country with Cotton and Stone, was a distinguished writer, whose works made up a part of the literature of that age. He wrote a work on church discipline, and published a volume of sermons.

John Norton was one of the great scholars of that early time; he wrote a Latin book in answer to certain questions put to him by the divines of Zealand, and many other works upon theological subjects, taking rank with Cotton and others of his school.

While literature was cultivated, mathematicks were not forgotten.—John Sherman delivered lectures on numbers, and on moral and political economy, as far as the science was then understood. He taught all who listened to him, how to make the best use of the means heaven had given them; both spiritual and temporal.

Winthrop, governour of Connecticut, was son of the chief magistrate of Massachusetts, and a learned man; he was a philosopher.

Roger Williams, who was the founder of Rhode Island, possessed more learning than he had credit for in those days, as his creed was objectionable to many; some of his poetry, and his vocabulary of the Indian language, have come to light of late years, which place him among the best bred scholars of that age.—He is the father of toleration in this country, which is praise enough for one man.

Among the most gifted minds of early times was that of Ann Hutchinson, the wife of a respectable representative in the legislature from Boston. She was metaphysical and eloquent—she admired Cotton, and he had a great respect, as a man of intellect must always have, for a woman of such commanding talents.—She had meetings of women, and broached what the lords of creation thought new doctrines. There was a little touch of what is now called Swedenborgianism in her creed, for she asserted "that believers are personally united with the spirit of God;" and perhaps she assumed a deeper look into futurity than most other women. All this was harmless enough, but not so for the grave divines of her time. They called a synod in 1637, the first ever called in America. This convention condemned eighty-two of her erroneous opinions; and the poor woman, for thinking deeper, and reasoning probably better, than her judges, was banished from Massachusetts. She was a fine spirited woman, and ought to have been made a teacher in the churches, instead of receiving a decree of banishment. She went to Rhode Island, "the asylum of heretics," the highest eulogy that ever was pronounced on any State. She lived there a few years, when her husband died, and she removed to New York. In 1643, she, and the rest of her family were slain by the Indians; this was considered by the superstitious as a just punishment for her numerous errours in religion. The Hon. James Savage, one of the first scholars of this country, is descended from Ann Hutchinson; and prides himself, no doubt, on his ancestry, for who would not be vain of having descended from such a gifted woman?

Elliot had versified David's Psalms, which were unpopular; and Dunster, president of Harvard College, a ripe oriental scholar, attempted to revise them; it would have been better had he attempted to translate them altogether anew. This corrected version was at length superseded by that of Tate and Brady; which was in the next generation superseded by the fine version of Dr. Watts.

The first tragedy written in America, was from the pen of Benjamin Coleman, while he was a student in Harvard College, entitled Gustavus Vasa, and was enacted at Harvard College at a regular commencement. He studied divinity, and was settled at Boston. He was eloquent and affectionate, and was called upon to pronounce the eulogies of most of the great men, who died in his time. From his sermons, more than a hundred in number, many facts have been taken for the biographies of the "illustrious men who were his predecessors."

Others were also distinguished as scholars, divines, and philosophers; but none more so than the Mathers, father and son. Increase, the elder, was president of Harvard College, was an agent for the colony in England, and wrote a great many excellent works. He was one of the chief labourers in the literary vineyard; and as such, was surpassed only by his son Cotton, the greatest prodigy of learning, of this, or of almost any other age or country. Cotton Mather was born in 1663, at which time the whole country was new, and the views even of the statesman and divine extended but little beyond the plantation, as a religious community, and before many had looked forward to the growth and power of the Colonies. Cotton Mather was the most voluminous writer that ever appeared in this country. The number of his works, ac-

cording to one of his biographers, amounted to 383; many of them of considerable size. The Magnalia is the one now most often read. It contains a great portion of historical matter, and often serves for data to those who most violently abuse the author and his writings. A deep hatred against him, was fixed in the minds of many, at the course pursued in the affair of witchcraft in 1692, and previous. Mather was deceived, for he could not have intended to do wrong, and has only the sin to answer for which lies at the door of many now-a-days, "*of forgetting, in their zeal to do good, the necessity of examining the means they use to effect their purpose.*"

To Robert Calef, we owe much; he was opposed to Mather's course, and came out boldly against it. His facts are clearly stated, and his reasons fairly given. The common sense of the people was awakened, and the whole delusion vanished, but not without a struggle on the part of the Mathers, and their friends.

Michael Wigglesworth, was contemporary with Cotton Mather, but his senior.—He was an invalid most of his days, and his mind naturally turned on solemn subjects. As was not uncommon at that time, he acted in the double capacity of divine and physician to his flock. He was, for many years, confined to his house, and there he sought to do good by his poetry. He published a poem, called the Day of Doom; it was a poetical description of the great and awful day of judgement. He also published a discourse on eternity, and several other short labours upon the solemn subjects of a change of worlds. Wigglesworth was a poet of no ordinary genius, and of extensive acquirements. His descendants, down to this day, have, in every generation, been distinguished for talents and learning. There is a deep feeling in his Day of Doom, which only wants the skill of modern verse, to make greatly effective. The same thoughts, wrought up by Scott or Moore, would be admired.

The first century of New England history was closing as the Mathers went down to the tomb. The scholars now in life had been educated at Harvard College, and all the statesmen and literati seemed to consider this their native land, which had not been the case for a great part of the first century. Connecticut now put in her claims for distinction. She had commenced a college, and could already boast of many intelligent men in every walk of life. Good Dean Berkeley, and others, had been roused by the reputation the colonies had acquired, in their short existence, and were desirous of having a share in the literature of the country.—Berkeley foresaw the coming glories of this country; and though it was not in the nature of things for him to realize his anticipations, yet his visions were prophetick. What he waited for and expected in his day, came in due time, even in less than a century. He is not less a seer that foretells events, because he cannot answer for times; things are often disclosed when the hour of their advent is hidden, notwithstanding this: the little poem by the Dean upon this country has been and still is considered a sort of prophecy.

When William and Mary came to the throne of Great Britain, a new charter was given to Massachusetts, and war and conquest, in some measure, took the place of religious discussions. Sir William Phipps brought out lawyers with him, and some new books, which had an effect on the taste of the times. Publick schools were now cherished; commerce was engaged in; and the whole people began to believe that they were destined for something more than a mere plantation for religious purposes. The people began to think that the press was intended for more than an instrument to make numerous copies of a book, and held it in the light of a security for the liberties they possessed.—Book printing had been known in Boston for many years before a newspaper was established. In 1636 books were printed, but it was not until 1704 that a newspaper was established. In 1686 there was a press set up in Philadelphia, and in seven years afterwards in New York—but pamphlet printing constituted the most of the business. The clergy were the great patrons of the press for the first century.

The News Letter was published at Boston in 1704, and continued for the space of seventy-two years, un-

til after the commencement of the war of the revolution. The Boston Gazette was next established, and the third was the New England Courant, by the elder brother of Benjamin Franklin, and in which that great philosopher was engaged as an apprentice. The first paper published in Philadelphia was issued in 1719, and the first in New York in 1725.

Among the most valuable writers of this country was Thomas Prince, the chronologist; he was a fine scholar, deeply read in civil, military, and ecclesiastical history. He travelled, became an excellent oriental scholar, and returned home fraught with all the collected wisdom of the old world, and at once set about doing something for the honour of his native land. He was the first who gave an account of the Aurora Borealis in this country. This phenomenon was seen by most with superstitious dread; but he met it upon sound principles of natural philosophy, and calmed the fears of the publick. His productions are numerous, and are all marked with great good sense; but his chronology is the most esteemed of all his works, for its profound research. It is to be lamented that he did not bring his work down to more modern times. He spent too much time on the fabulous or doubtful parts of history to finish a table of the minute events of his own times. His labours should be continued by some of his countrymen, for there are ample materials for such a work; but perhaps whoever would undertake the task, would find himself but ill-paid for his trouble, and mortified as Prince was, at its slow sale; for while the publick were praising the work, the writer was left to pay the printer. It is often to be regretted, that the book which the learned admire, and extoll, finds, perhaps, but few purchasers.

Benjamin Franklin was born in 1706, and while a youth, was distinguished for his talents. He marked out a new path for himself. His essays were plain, and so full of good sense, that he became at once a popular writer. In 1732, he began his Poor Richard's Almanack, which abounded in such aphorisms and sayings as would attract all tastes and were useful for all conditions.—He then became a political writer, and was the first to gather a sufficient body of statisticks to form correct opinions, and probably was the best informed man on general colonial subjects in the country. He next made many experiments in electricity, for the safety of human life. He also suggested a plan of union and defence for the colonies. His whole life was one long day of mental efforts, and his writings have an influence on this enlightened age.

David Mason, a pupil of Franklin, in a few years after the philosopher's experiments in electricity, gave lectures upon the science, and excited the wonder of the people at the phenomena he exhibited by his machine. He was also acquainted with the science of chymistry, as it was then known in Europe; and was called by the legislature of Massachusetts to teach the art of making gunpowder.

From the first settlement of the country, the almanacks had exhibited a sufficiency of science for their general purposes, and oftentimes much more; and the literary information they contained was profitable, and widely diffused.

Doctor William Douglas wrote a summary account of the colonies, and something on botany, statisticks, and political economy.

Paul Dudley was the first in this country who turned his attention to natural history, and some of his papers are specimens of fine writing.

Mark Catesby's works at this time became known. He travelled through Virginia and South Carolina; both of which abounded in plants, animals, and eminent materials for a naturalist. He returned to Europe, and procured assistance in getting out his work; a production which has much assisted our botanists in later times.

The science of mind had now begun to call forth the attention of the ablest men in this country. Polemick divinity had lost some of its popularity, and new paths of learning were to be explored. Among the most distinguished of these philosophers, was Jonathan Edwards, who wrote on the "Freedom of the Will." This work has received the highest encomiums from those great

men of Europe, who have made metaphysicks a study.—Sir James Mackintosh, in the last labour of his mind, spoke of Edwards with profound respect. The works of our metaphysician have been published in eight octavo volumes, of large size, and, to the credit of the country, sold well. His son was quite as profound in the science as his father, and his style more clear and attractive; but the second in any pathway, has generally less fame than the leader.

In 1763, the subject of introducing bishops into America, brought forward some of its best writers, among whom was Abthorp, rector of the episcopal church in Cambridge. It was a harmless affair in itself, but was made, from fears of the orthodox puritans, a matter of moment. Seabury, Johnson, Chauncey, and Mayhew, all engaged in the controversy, and displayed no ordinary talents. In Mayhew's productions there was much energy and bold freedom of political remark. He discovered no partiality for Saint Charles I., and refused to put him upon the calendar of the pious army of martyrs, although it was certain that he died after the manner of them. Doctor Mayhew was one of those men who enter so deeply into the affairs of their professional duties, that they forget how much is justly due to their animal nature—and wore himself fairly out, before he had reached the best age of mental labour. He died at the age of forty-six, of a nervous fever, brought on by excessive study.

Several institutions of learning had been founded, and were in a state of *hopeful experiment*, besides the college at Cambridge. Yale College was in a thriving condition long before the period to which we have brought down our cursory remarks upon American literature;—and the college at Providence, (now Brown University, and under excellent auspices,) had connected with it some fine scholars. Nassau Hall had been founded, and a circle of learned men were soon brought from its walls—the Burrs, and the Edwardses are among them. Columbia College, (then King's College,) had gone into operation before some of those we have mentioned; as also Dartmouth College, and all were doing well. There was now something fixed and settled, as it regarded future operations in the arts and sciences. At this juncture the revolutionary troubles came on—but there were mighty minds harnessed for the hour of battle. The mental resources of the country had been collecting for the crisis; and all were fearless in the cause. We pause a moment, to show who wrote on this subject. The currents of Time will let these records last.

Among the writers, whose works more immediately assisted in bringing on the revolution, we may record James Otis. In 1765 he wrote a pamphlet on the stamp act. This, at the time, was considered an excellent piece of fine writing, and was republished in London by the friends of America. The works of Mr. Otis were not numerous; and there can be no doubt, but that his fame as an orator, added much to his reputation as a writer; and more than this, the nature of his subjects at that time were all-absorbing. His writings, however, aside from their political character, had, it was agreed by friends and foes, great merit. He wrote, "A vindication of the conduct of the House of Representatives of Massachusetts," in 1762; the Rights of the British Colonies Asserted, 1764; and Considerations on behalf of the Colonists, 1765. These productions were scattered through the country, and every copy was read at least by five hundred persons, so popular was all he wrote at the time; and in the discussions upon the subject, more anecdotes of the effects of his eloquence were told, than ever Greek or Roman had in store for the fame of Demosthenes or Tully: but abating much for all the enthusiasm of the times, there can be no doubt but he had a powerful pen, and a tongue of fire.

Another of that band of patriots, whose writings did much to awaken and cherish the flame of liberty, was John Adams. He wrote several essays over the signature of Novanglus, in answer to some papers on the royal side, signed Massachutentis, written by a lawyer of the name of Leonard. These were papers creditable to both, as matters

of argument, and were admired and extolled, as people took sides. Mr. Adams was on the popular side upon the great questions then agitated in the country. During this period, he had acted in the highest political capacities; but here we have only to mention his writings. He published "A Defence of the American Constitution," to appease an opinion then prevalent among many patriots, that a single assembly was the only true government. This opinion was advocated both in England and France, and it cannot be denied, was favoured by Franklin. Mr. Adams ransacked history to show that such a government was defective, and the theory is now at rest. In his old age, and in retirement, Mr. Adams poured out his opinions in a series of pieces, which afford the statesmen many early facts, and opinions which are valuable to the historian. His style was bold and characteristick, and evinced marks of deep reading, and profound reflection.

Samuel Cooper, a clergyman of Boston, was a constant writer in the cause of liberty. He wrote a political discourse, as early as 1759, on the taking of Quebeck, which directed the attention of the politicians of the day to him, as master of a fine pen in the cause of rational liberty. All his writings, from that time, had a bearing on the great question between the mother country and the colonies. There was an eloquence and grace in his productions, beyond the style of the times, and he became a man of wonderful influence in all political controversies. Works of this nature, in some measure, lose their charm in an after age,—but Cooper's writings are tasteful at this day.

Josiah Quincy ranks among the writers of that day as wielding an elegant pen. He was a man of genius, and earnestly engaged in the cause of freedom: and when the Boston *Port Bill* came to this country, and was put in force, he wrote a pamphlet, entitled, "Thoughts on the Boston Port Bill, &c., addressed to the freeholders and yeomanry of Massachusetts." It was spirited, and in many parts highly eloquent. He had much of the Grecian spirit, and not a small share of Athenian eloquence. He fell a victim to his vigils of patriotism in early life.

One of the best writers of the age, was John Dickinson, who was born in Maryland, but was active in Delaware and Pennsylvania. In 1767, he began to publish tracts against the taxation of the colonies. These were masterly productions, and deserve to rank among the best specimens of American genius. He was a member of the Congress of 1774; and his pen was frequently employed in drafting the most important state papers. The address to the inhabitants of Canada, the first petition to the king, the address to the army, the second petition to the king, and the address to the several states, were written by him. One of these petitions to the king, was the production which called forth the memorable compliment from Lord Chatham, in which he called him superiour to any classical writer of antiquity. While president of Delaware, he published a proclamation to his people, full of lessons of wisdom. When the constitution of the United States was under discussion, he wrote a number of letters, signed Fabius, in order to forward the adoption of it, which merit reading at the present day. Many other works came from his hand, all tending to publick good. His works have been collected and published in two volumes; but are now only to be found in publick libraries, and with those who are lovers of the curious and rare; they ought, and will be reprinted, and placed along side of the FEDERALISTS and other standard works of American literature.

South Carolina boasts, and with justice, of her patriotick writers in the great cause of freedom, one of whom was William Henry Drayton. He was a prime scholar—enlightened and polished by foreign travel. On coming home, he became at once a patriot, and took up his pen in the cause of his country. He wrote a pamphlet, addressed to Congress, under the signature of "Freeman," in which he expatiated upon the grievances of America, and then openly stated their rights. He also published a charge to the grand jury of his state, which is now incorporated into the history of those times.

He also wrote a history of the American Revolution, but his materials were not so extensive as those of Ramsay and others.

William Livingston, of New Jersey, wrote many things to rouse the people of his state to vigorous exertions in the cause of liberty, and was justly ranked among the patriots and fine writers of his time. He was not confined to one department of literature, for his poetry had as much spirit as his prose. He presented to the New York Historical Society, or his son did, from his library, the journal of the British House of Commons for several years, comprising the period commencing a year or more before the death of Charles the First, and extending nearly to the time of the restoration. They are proved to be genuine and original from the following indices, viz.: from the water-marks of the paper on which they are written; the first volumes have the royal stamp on the paper; the next, the fools-cap and bills, ordered by government in derision, to take the place of the royal arms;—this continues for some volumes, and then appear the arms assumed by the commonwealth; and then, those of the lord protector, Oliver Cromwell. These volumes unquestionably were brought over to this country by the regicides, who wished to hide the record of their proceedings, in order to prevent Charles II. from finding out all that was done in his exile. This was the safest place for them, and here they will be preserved for future history. It is a singular fact, that every English historian is silent upon their loss, and no one has ever pretended to quote these journals; yet much useful matter may be extracted from them, and many things that English history does not contain may be found there. Some one of the Livingston family may give a minute history of their being found in this country. It would be as acceptable as curious.

David Dulany, of Maryland, was one of the writers upon political subjects, previous to the revolution. He wrote several treatises on the great subjects of taxes and other matters, which agitated the colonies at that time; but he did not live to see the end of the contest, in which he had so heartily entered and with so much reputation. He was one of the number who were early called to their account; but it is a remarkable fact, that those who entered into the cause of freedom—heart and soul—lived longer than most other men;—whether it was because they were animated with heroick sentiments, or from some other reason, the fact is nevertheless certain, that the signers of the declaration of independence, as a body of men, arrived at a greater age, and died more quietly, than any fifty-six that could ever be named, as acting together in any important national concern.

Virginia had her share of good writers, who were engaged in enlightening the American people during the revolutionary contest. The Lees were among the most distinguished. Richard Henry Lee, among other works, wrote what has been called the "Farmer's Letter," and the second address to the people of Great Britain. These productions evinced patriotism and scholarship. Arthur Lee, his brother, was also a political writer of distinction. He wrote letters under the signature of JUNIUS AMERICANUS, which held a high rank at the time, among the literati of America. Mr. Jefferson wrote the declaration of independence, Notes on Virginia, and a Manual of Parliamentary Practice for the use of the Senate of the United States, which was an abridgement, with some alterations, from Hatsell's great work on the same subject. Hatsell was clerk of the House of Commons from 1768 to 1797, and was thoroughly acquainted with all the rules and order of parliamentary proceedings, which is a science in itself, not thoroughly understood by many politicians. Mr. Jefferson's acute mind at once penetrated the arcana.

It would be unjust to pass over General Joseph Warren, who fell at Bunker Hill, in our notice of those who had added to the stores of American literature. He was a frequent writer in the periodical journals of the day, where he poured forth all the warmth of his soul. He delivered two orations on the Boston massacre, one in 1772, and another in 1775; and perhaps no two orations since the days of Demosthenes' orations against

Philip, ever had such an influence upon an audience, or such an effect upon the people generally. These productions have been used for declamation by every schoolboy since that time. The burst of indignation—the high toned patriotism—the fundamental maxims of a free people, all came in torrents of eloquence; and its effects were felt through the country. On the 17th of June, 1775, he sealed his course with his blood, being the first martyr of the revolution. He was assisted in defending the views of freemen and their rights, by Hancock, Church, and others of note, who were zealous in the cause of their country.

The literature of the revolution, was bold, direct, and without any affectation. Any high exertions of mind will produce new and ardent expressions; and these, after a while, will be moulded by taste. If you take the orders and proclamations of Washington—the letters written by him in the exigencies of the moment,—there will be found that strength and felicity of expression, that is supposed to be the offspring of care and leisure. Some of the writings of Knox, Schuyler, Brooks, Laurence, and others, during the most gloomy parts of the contest, are marked with excellent sense, and often are elegant compositions. The commentaries of Cæsar, were written in a camp.—When the mind is under excitement, we often find that it receives the best method of thought and expression. In the intercourse of a camp, some minds are always found, which give a direction and tone to the rest. It was so in our army; and even in a prison, instruction may be received.

It is a singular fact, that the diplomatick correspondence of the revolution has not been surpassed; nor has modern times improved much upon the styles of Adams, Washington, Lee, Jefferson, Hamilton, or Dickinson. The poets of those days, had not the models before them, that they now have; but few productions contain more elegant satire, than can be found in M'Fingal, or more patriotism than can be discovered in the arousing songs of Freneau. When one mind pervades all classes of men, improvement is rapid; every beam of light that is reflected, and refracted in a community, acting in unison, increases the force and power of the ray. If the whole nation had gone to school, instead of going to fight, they would not have learned as much as they did in the eight years' war they waged for independence. Heaven never intended that the choicest blessings should be had without pains and labour.

Since the revolution, we may fairly class the writers that have been conspicuous in our country; for, notwithstanding our habits and forms of society did not allow any one to follow exclusively one course, yet there has been a finer opportunity for men to display their particular talents, than there was when every one bent his whole soul to one great object, that of gaining for his country the rank of an independent nation. A nation, like an individual, must go through a course of discipline, to form a character. It might be impossible to form a nation that should bring all their energies to the best possible direction, without going through a series of difficulties, teaching forbearance, sacrifices of local prejudices, and making each part acquainted with the characters of the whole. The revolution contributed as much to the advancement of learning, as it was necessary to the formation of national character.

Before the revolution, it was difficult to place our writers into classes, for almost all were miscellaneous in their productions; since that period, notwithstanding no man has exclusively followed any one branch of learning, still the classification is more distinct than in former times, and we shall give an account of our authors and their works under distinct heads.

History and Biography.—Ramsay's history of the United States, ranks among the best works we have in our libraries. He had ample materials for his work, and particularly that part of it which relates to the revolution, as he was a member of Congress, at one time president of that body, and consulted with Washington upon all the important events of the revolutionary war. He was a fair-minded historian. He also wrote a compend of universal history, which did him great credit.

Holmes' Annals of America, from

1492 to 1826—the second edition in two large volumes, is one of the most useful works ever printed in the United States. It is pretty copious, very correct in dates, and in description of events, and adorned with much accurate and excellent biography. It is written by a scholar, who had no prejudices, who is a great antiquarian, and a lover of his country; and if it now and then shows a little more partiality to saints of his own creed than to saints of another creed, it requires no small sagacity to find it out. Every future historian will plunder him; but it will be impossible for any one to abuse him. A more unpretending, and a more valuable work, was never published.—Marshall's history of the Colonies, and, his life of Washington, are valuable works; what they want in the charm of fine writing is amply made up in accurate observation and impartial delineation.

The histories of the several States have been written with more or less ability. Belknap's history of New Hampshire is a work of merit. He had access to the best materials, and he wrote with honesty, intelligence, and taste. In fact, it is one of the best specimens of the style of our writer's extant. It is a remarkable fact, that no one has attempted the subject since, except in the way of illustration or explanation.

Sullivan, a man of genius and learning, has written the history of the District, now the State, of Maine, but his materials were scanty, and notwithstanding he did all that a man of talents at that time could do, yet a more copious history of that growing state is wanted.

The history of Massachusetts has been more fully written out than that of any other state. In addition to the works of Winthrop, Hubbard, and others of the early settlers, we have many of modern times that are worthy of notice; such as Minott's and Bradford's histories of Massachusetts, and Hannah Adams' History of New England. This lady was one of the most candid and accurate historians that ever wrote. She set down no assertion that had not proof to support it, nor one that had a particle of prejudice to be abstracted from it. It may be said, without fear of contradiction, that the historians of New England have been more assiduous than those of any other portion of this extended country.

Trumbull's history of Connecticut is a good ground-work for a future writer. He is explicit and honest; had nothing to disguise, nor did he "set down aught in malice." The history was an eventful one, and he handled it with great simplicity.

Professor Williams has written a history of Vermont, but that state has so wonderfully increased in population, wealth, and character, that it will be only the ground-work of a more full history: but it is fortunate that this ground-work is so philosophical. The commencement of most histories is fable and romance—this is otherwise, being fact and philosophy.

Flint has written a history, and given some account of the geography of the Western States. He is shrewd, capable, literary, and eloquent. It is impossible that he should have done entire justice to this new world in so small a compass—but it is the first of all considerations, that what is done, should be well done,—this praise no one will deny him. It is to be wished, that he may live to fill up his great outlines.

In modern times, Yates and Moulton have written most excellently upon the history of New York, and these men are capable of giving a full history of this state; but this will not probably be done, until the government of the state make some provision for forwarding the work. To give a fair and correct history of this state, requires more research and labour, than to write the history of any other of the states, as more than half a century of it is in Dutch records. It is said that the materials are ample, and there can be no doubt of it, as the Dutch were the most minute, pains-taking, and accurate of the nations of Europe, and they could not have been wanting in making journals and observations on all the passing events of the times in which they lived. New York, the centre of the Union, and the mart of the world, should have minute and well written accounts of all she has done, and all she is.

Stoddard has made some judicious sketches of the history of Louisiana,

which deserve credit: but that old territory, though new to the United States, deserves a full history. It is already, and every day becoming more important to the United States, and should be fully known to all the members of this great republick.

M'Call has, with considerable talent, given us a history of Georgia; but there is a more ample field than he had at that moment means to explore. This state is now a large one, although the last settled of the old thirteen states. The character of Oglethorpe, the founder, has not yet been fully written out.

The histories of Ohio, Kentucky, Missouri, Indiana, Mississippi, and other new states, have only been partially written. The lovers of history should, at this moment, set about making exertions to have all the facts relating to those interesting sections of the country gathered up, and put into proper form.

Pitkins' Political and Civil History of the United States is a valuable work. It covers a period from 1763 to 1798. This work shows us more of the labours of the statesmen of that period, than any other production. Miller's Retrospect of the Eighteenth Century is a work of great research. It was printed at the commencement of the nineteenth century, just as American literature began to expand. Thomas' history of Printing is a curious book. The writer has done much for learning, by establishing an antiquarian society, and gathering a fine library for publick use. He was a printer himself, and had treasured up many important facts. Lyman's history of the Diplomacy of the United States is valuable to every statesman and historian. It required no small share of perseverance to collect and arrange such a mass of matter.

Mr. Sparks, an able scholar, who has the Washington papers, amounting to sixty volumes of manuscripts, and a mass of other matters from the Colonial office in England, is now furnishing the country with a view of these subjects, on a most extended scale. It will be several years before his labours can be finished, for he does every thing thoroughly.

In biography the country has been pretty well supplied since the revolution. Besides the Biographical Dictionaries of Elliot, Hardie, Allen, Rogers, and others, we have many works on this subject, containing only a few names, or, in many instances, only one name. Ramsay, Marshall, Bancroft, and Weems, have published lives of Washington in good sized volumes; and a hundred sketches of the father of his country may be found in the journals published since and before his death.

One of the most elegant pieces of composition to be found in our language of the kind, is Washington Irving's life of Columbus. He went to the fountain head for his materials, and spared no pains in working them up.

Tudor's life of Otis is a valuable work, not so much for delineation of character, as accurate historical anecdote. He was an excellent scholar and a great lover of his country.

The Lees of Virginia, whom we have heretofore named in this sketch of literary history, have found an able historian in one of their descendants.

Wirt's life of Patrick Henry has been one of the most popular works ever printed in our country. It has lately appeared in a new edition, with the memoir of the author, written in good taste.

Judge Johnson's life of General Greene, is an elaborate and a minute work, enriched by some of Greene's correspondence, which shows the directness and strength of his mind more than any thing could do unsupported by such proof.

A life of Governeur Morris has been given by Mr. Sparks, in addition to his other labours, which is a most interesting book; full of the events of the French revolution, a most important period in the civilized world. The same author has also given to the publick the life of the traveller Ledyard, whose sober history, without a particle of embellishment, is a romantick tale.

Sanderson's lives of the signers of the declaration, is a clever work. A volume containing their lives was printed at Hartford; and brief sketches of these distinguished men will be found in the first volume of the Treasury of Knowledge, from another hand.

Colden's life of Robert Fulton is a valuable work. It proves how much

can be done by genius and perseverance. Every inventer should read this book, when discouraged by untoward events; for never was there a more persevering spirit than Robert Fulton. Who has, in the end, done more good?

Brown, the novelist, wrote the life of Dr. Linn. It is a fine specimen of writing, and of warm and affectionate colouring. The writer and subject were poets and friends. There is a glow in this little work that would do honour to the pen of Burke.

Dunlap, the painter and dramatist, several years since published the life of Charles Brockden Brown. It is a fair and faithful account of that distinguished writer, who died before the publick could fully appreciate his merits. In the minds of many it was thought almost criminal to deal in fiction, and some esteemed it a species of falsehood; but since Brown's death this prejudice has been scattered to the winds by the magick wand of Sir Walter Scott, and many admirable lessons of wisdom been given through the medium of fiction.

Dr. Hosack's memoir of De Witt Clinton was written soon after that great statesman died. The work contains many valuable facts for the future historian, expressed in a clear and perspicuous manner. The obiturist seemed fearful of eulogy, and of being considered too partial to his excellent friend, and has spoken of him in a subdued tone, when he might have indulged in higher notes of praise.

The Poetry of the United States, *since the declaration of independence.*—The conquest of Canaan, an epick poem, by Timothy Dwight, was not published until 1785; this was hailed as a work of high merit. It was written when the author was quite young, and is full of poetry, certainly; and a hundred years hence, will rank higher than it now does. He wrote Greenfield Hill, and several other poems. Dwight was a man of genius, of acquirements, and virtue; but he lived too much with the pious and particular, to become sufficiently acquainted with those incidents that mark the pathway of mankind in general, a knowledge of which is so essentially necessary to the poet. He was a virtuous man and a good scholar.

Joel Barlow published his Vision of Columbus, in 1787, and dedicated it to Louis XVI. After the first publication, he remodelled it, called it the Columbiad, and made it quite another thing, in politicks. This has appeared in a most splendid edition in this country, and in the opinion of many, stands at the head of our poetry. He wrote other works, such as, Conspiracy of Kings, Hasty Pudding, &c.

General Humphrey also wrote poetry, and was considered as one of the poetick trio of Connecticut at that time. He, with Trumbull, Barlow, and Hopkins, wrote the Anarchiad. In 1782 he published a poetical address to the armies of the United States. He wrote a poem on the happiness of America; on the future glory of the United States; on the industry of the United States, &c. &c. He had more of the polish of the soldier than the spirit of the poet; but he has many admirers, and still holds a rank among the best and most patriotick writers of this country.

Richard Alsop was one of the Connecticut poets, who wrote for the pleasure of the hour. He has the credit of getting up the Echo, a work of great poetical power, sometimes in burlesque and sometimes slyly grave. This work contained some admirable hits upon the reigning follies of the times, and now and then drew a feather across a favourite's nose. Alsop left several unpublished poems, and published a good many things for amusement only. The Echo is one of the best satires ever written in this country. His coadjutors were Theodore Dwight, Trumbull, Hopkins, and others, not so distinctly known.

Mrs. Warren should have been named before these Lards. She wrote two tragedies, "*The Sack of Rome*," and "The Ladies of Castile." These were written during the war, and all for patriotick purposes. Previous to them she wrote a play, called "*The Group*," which contained some forcible satire, and had a decided effect at the time. She was a sister of the great patriot, James Otis, which gave some eclat to her writings. She was a woman of genius, and a good writer.

Judge Dawes, at the close of the revolutionary war, wrote some fine poetical pieces, among which were "The Law given on Sinai," and "An Ode on the Death of James Otis."

Dr. Joseph Brown Ladd, who died in Charleston in 1786, in the twenty-second year of his age, was a fine poet. He wrote many things worthy of being preserved. His sister has lately gathered up all the pieces she could find from his pen, and published them in a neat volume. It does credit to her affection and his genius. It contains a short but elegant biographical notice of Ladd from the pen of William Chittenden, Esq., a tasteful and spirited writer of the city of New York. His prominent poems are, an "Ode to the Sun," and "The Appeal of Almasi, the wife of Almaz Ali Cawn, to Warren Hastings, governour-general of India." He wrote many other pieces, particularly a series of poems under the signature of Arnoret. These productions, and many of prose, from his pen, bear marks of genius, and of precocious acquirement.

John Blair Linn wrote poetry of no ordinary character. He was a lawyer, a dramatick writer, and then a divine. He wrote a poem on "the Death of Washington," "The Powers of Genius," and a play called "Bourville Castle." He died young, much respected.

Robert Treat Paine claims a high rank among the poets of his time. He wrote "The Invention of Letters;" "Adams and Liberty;" and "The Ruling Passion;" with occasional songs and odes; one, "the Steeds of Apollo," was his last, and in better taste than most of his other productions.

John Lathrop was contemporary with Paine. He was a poet of taste, but did not write much. His longest poem was entitled "*Canonicus*," published first in Calcutta, and reprinted in Boston.

Charles Prentiss was among the bards of that time. He had taste and versatility. His "Will," a playful poem, written while at College, gave him a high rank in the catalogue of wits and poets of the age.

William Boyd wrote a poem "on Woman," remarkable for delicacy and smoothness. It has been read by the fair ever since, if not with the highest admiration, certainly with great pleasure.

William Clifford, a young quaker of Philadelphia, burst out into a most courteous address to Gifford, praising him for his Baviad and Mæviad. He wrote some patriotick songs, which were quite famous in their time. What he wanted in the inspirations of the muse, if any thing was wanted, he made up in patriotism.

Paul Allen, Isaac Story, Captain Spence, and Selleck Osborne, were all poets, and some of them have been highly praised, and no doubt with propriety.

Some few who have written since, have gone to their long account, and of course we can speak of them as if they had not been our contemporaries. Some of them wrote beautifully, and their works should be preserved by the generations to come. It is easy for the just to secure what the envious would wish to destroy.

John G. C. Brainard, who died a few years since in Connecticut, was a man of talents and principle. The columns of the Hartford Courant bear testimony to his acquirements and taste. A friend of the deceased has gathered up his fugitive poems, and printed them with a delicate memoir of the poet. His temperament was sensitive and melancholy. He loved not the world, and was taken from it early, being only thirty-two years of age.

Robert C. Sands, who has lately descended to the tomb, at the same age, was a fine scholar, of exquisite taste, and devoted to literary pursuits. He was one of the authors of that fine poem, Ya-moy-den, which he wrote in company with young Eastburn, who died several years before Sands. His works are now preparing for publication by his friends. Some of his poetry, written when quite a boy, is not inferiour to the early productions of Henry Kirke White. Sands was one of the best classical scholars of our country, and his works will be read with pleasure, as containing many flights of a vigorous and fastidious muse.

We pass over the living poets, still with pen in hand, without comment, as the time has not come to do them justice, or to speak of them with freedom. Many of them have ac-

quired an enviable fame in the pursuits of literature—Bryant, Halleck, Dana, Sprague, Pierpont, Nack, Wetmore, Mrs. Sigourney, Miss Gould, Mrs. Ware, Mrs. Hale, Mrs. Child, Woodworth, Willis, and hundreds of others, who occasionally cultivate poetry as an amusement, but few or none of them as a profession. Our votaries of the muse are often discouraged from venturing on the wing, from watching the flights of the eagle geniuses across the water, forgetting that most of these writers make poetry the great business of their lives. Should some of our most gifted writers devote themselves assiduously to poetry, we might soon vie with England in poets as we have in orators. Life is too short for any one to attend to many things. Few American poets keep their pieces "nine years;" their productions often reach an annual, or some periodical, in as many hours; being things thrown off as occasion demands, or as caprice may inspire.

Divinity.—In 1793, Doctor Hopkins, a shrewd and deep metaphysician, published a system of divinity, which was the foundation of a new sect. He differed from Calvin in some things, pushing his doctrine even beyond the great reformer himself. This system had a host of opposers, many of them very learned men.

Doctor Timothy Dwight's system of divinity, published since his death, is the most voluminous in the country, is remarkable for clearness and fairness, and seems to be the most popular of all the theological works ever printed in the United States. The beauty of his life gave a charm to all matters from his pen. His doctrines are distinctly Calvanistick.

For several years, a spirited controversy was carried on between the orthodox and the Unitarian clergy, in which several gifted and learned men took part—Noah Worcester, Samuel Worcester, Mr. Stewart, Doctor Wood, and others, on the side of Calvanism; and Doctor Channing, Mr. Norton, Doctor Ware, Mr. Whitman, and others, on the Unitarian side. It was a "war of the giants," and they perhaps now only rest from their labours, neither being vanquished. The reading public have derived much instruction from this collision of mighty minds.

Doctor Emmons has published several able discourses, which should be read by those who do not, as well as by those who do, agree with him in sentiment: Emmons belongs to the Edwards school of metaphysicians.

Doctor Freeman has published a volume of sermons. Those who do not follow his creed, must admire his liberal views, and his pure and elegant literature.

Joseph Buckminster's sermons, published since his death, have more of the charm of fine writing than any that ever have been published among us. If, as some have said, there is a want of evangelical divinity in them, even these critics could not deny the fact, that there is an Apostolick purity running through them, which chains the heart to the memory of such a man, and fixes the attention to so sweet a writer. His Phi Beta Kappa oration is a splendid specimen of writing. His friend Thatcher wrote a memoir of his life. It was a description of a bright, particular star, that rose, culminated, and set for ever, while the magi were gazing at it.

Others have written volumes of sermons, and almost every clergyman prints an occasional discourse; but as yet, few works on theology, written in the United States, have issued from the press. There are several theological periodicals that discover great learning and research. The Christian Examiner, published at Boston, is much read and admired by the Unitarians, and commands the respect of other sects for its chaste literature, gentlemanly courtesy, and high moral tone.

The Biblical Repository, published at Andover, in Massachusetts, is a quarterly work. It is learned, and every day rising in reputation. Andover Theological Institution met with much opposition in getting a charter. One of its advocates said, at that time, "no matter what creed they avow, give them an opportunity to become learned, and they will, in the end, be right, whether it be your creed or mine, or neither, they shall hereafter teach." The Christian Spectator, published quarterly, at New Haven, is one of the most acute and candid of all the reviews in the whole country. We differ from ma-

ny, in thinking that the science of theology is yet in a crude state among us. We believe that it has received more attention than any other science, and is better understood. It is a science which can never be brought to any degree of perfection. That part of it which is founded on nature, is as well read as it ever will be in regard to a reverence of the Creator; and that which is founded on the faith once delivered to the saints, will, in a free country, for ever be construed by each one as he pleases. Between man and his God, there is a communion that no philosophy can long interrupt, and no false glare long delude. Man knows his responsibility; he feels it every hour, and if he is "taught to stray" for a season, he comes back with a due sense of his dependence, and of the necessity of forgiveness and mercy. There are several, it is said, who are deeply engaged in giving us true versions of the scriptures; we wish them success. It cannot be doubted, that it is not only the prerogative of man to be constantly reasoning upon his Maker, as well as his own being;—his benevolent God has so ordained it, and the creature should be in the discharge of his duty. Toleration, which our constitutions of government sanction and defend, can alone advance the nation in the service of theology.

Fiction.—As we have before remarked, the grave character of the people of the British colonies in this country, almost entirely precluded works of fiction. But among the first who ventured indirectly to break the spell, was a reverend divine, Doctor Belknap. He wrote the Foresters, a story made up to divulge some of his sentiments upon history, politicks, and manners, which he thought it was not prudent to express directly. This work was extensively read in every part of the United States, and much admired.

At the head of American novelists, is Charles Brockden Brown. He published several novels, viz. Wieland, Ormond, Arthur Mervyn, Edgar Huntly, Clara Howard, and Jane Talbot. They were admired by a few men of feeling and taste, but he was suffered to expire before they reached any prominent eminence. Since his death, they have been reprinted in this country and in England, and have received no small share of praise from able criticks. No one who has read his works, will deny them the merit of striking incident and vivid description.

Mrs. Foster, soon after this, wrote "the Boarding School," and "the Coquette." The latter caused considerable excitement, as some of the principal characters were well known. These works had the merit of being written in good English, and the Coquette was a sad tale, too true to be called fiction.

Mrs. Rawson, who for many years was at the head of a school for young ladies, wrote, besides school books used in her institution, several novels—Charlotte Temple; the Sorrows of the Heart; Montoria, or the Young Lady's Friend; Sarah, or the Exemplary Wife; Reuben and Rachel; a sequel to Charlotte Temple; and several others. These were all read with avidity, for it was well understood that her English was good, and her motives pure. Charlotte Temple went through nearly twenty editions.

Since the novels of Walter Scott have been extensively known, several candidates for fame in this path have started forth; but no one has gained more celebrity than James Fennimore Cooper. His Spy, Pioneers, Red Rover, Last of the Mohicans, the Wept of Wishton-Wish, the Pilot, and others, have all been extensively read and much admired, not only in this country, but in England, France and Germany.

James K. Paulding has written several good novels and works of satire. His John Bull in America, made those for whom it was intended, feel severely. His Dutchman's Fire-side, and Westward Ho, have been very popular. He is a prompt and rapid writer. Having been one of the authors of the Salmagundi, placed him early on elevated ground.

Timothy Flint, of the Western country, has written a novel called Francis Berrian, that has been much admired, not only at the West, but also on the sea-board. He has devoted himself to literature, and deserves the generous patronage of that growing empire.

Miss Sedgwick is among the very

best writers in the United States; always sensible, correct, and moral. She sees clearly, and expresses forcibly what she means. Like Miss Edgeworth's works, her Redwood, Hope Leslie, and Clarence, will be read in future days with as much interest as they are at present.

Mrs. Child's Hobomok, Rebels, &c. have been justly praised, and by those who have taste and judgement.

Law.—For many years the press has teemed with reprints of law books; to many of them notes have been appended. The twelve thousand practising lawyers in the United States, are in general well provided with law books. Not only the laws of every state, but the reported decisions of most of their highest courts, are readily found in every city, town, or village. Some of the best scholars of the country have been engaged in multiplying books on the science of law. Books of pleadings, and practice have been published in almost every state in the union, and have afforded excellent guides to the practitioner. It would exceed our limits to name a tithe of them. A few who have engaged in great labours we will mention. Mr. Adams wrote an essay on Canon and Federal Law, which had a great reputation at the time. Nathan Dane was engaged for forty years in making an abridgment of the law, which he finished eight or ten years since, and published it in six large octavo volumes. He is considered one of the profoundest lawyers of the country.

Chancellor Kent's Commentaries on American law is considered by competent judges, to be one of the best works since Sir William Blackstone published his commentaries.

Judge Story's overflowing and excursive mind, has been busy upon almost every part of the law, from Constitutional Law to that of Bailments, Shipping, Bills of Exchange, &c. &c.. The bar and the bench are deeply indebted to this indefatigable jurist, who has brought the mind of a statesman to the detail and principle of jurisprudence.

Louisiana is indebted to the late secretary of state for the United States, Edward Livingston, for arranging the civil code which is now in force in that state. By this code, every action is commenced by short petition or statement. The whole of the complex machinery of the common law is dispensed with, and the forms of special pleadings unknown in their courts. Mr. Livingston has been employed for several years in forming a code of criminal law. It is divided into a code of crimes and their punishments, a code of procedure, and a code for regulating Penitentiaries. The whole is a work of great labour, deep research, clear views of human nature, with a current of benevolence running through it, that has made it the admiration of the enlightened in every country. If the code is not in all its parts adopted, its spirit will, in time, pervade the criminal code of all civilized countries.

Medicine.—We have mentioned the physicians who were conspicuous previous to the revolution in another place. Since the peace of 1783, there has been more activity in the profession of medicine and surgery than in any other. This profession furnished several brave officers in the revolution, and many statesmen since; among them were, Brooks, Cobb, Mercer, St. Clair, Gadsden, Bricket, and many others. The first martyr in the cause of the revolution was Dr. Joseph Warren. His brother, Doctor John Warren, was surgeon-general of the northern army, and left the office to pursue his practice in Boston. The Medical School at Cambridge was got up under him, and a few others. Dexter, Waterhouse, and others, were his coadjutors in the cause. This was the second medical school established in the United States. Dr. Rush had devised a medical school in Philadelphia previous to this time, which may be considered the first in point of time, as it regards its foundation, and most assuredly has been second to none in its success in forming the medical mind in this country. The one in New York followed, and it has been honoured by distinguished professors. The classical Bard; the learned Mitchill; the tasteful, indefatigable and copious lecturers, and medical writers of a more modern day, Hosack, Francis, Smith, and many others—have added to the science of the healing art, besides exerting a fatherly care over science and letters in general. The medi-

cal school at Dartmouth College was the fourth in the country, has flourished ever since its commencement, and with its seniors, is every day enlarging its influence. Since that period many others have grown up, which have produced many distinguished professors of surgery and medicine. It is now difficult to succeed as a quack, except in some of the most ignorant parts of the country, and there they are often ferreted out.

Medical Journals are now before the publick as periodicals, which do honour to the talents and acquirements of their conductors and contributors; and it is not a little in favour of the profession, that the faculty are among the best friends of learning in the country. The fears that were once entertained, that the study of medicine and surgery lead to materialism, is now done away with; for it is now conceded that the studies connected with this profession, when fully carried out in the forms of physiology, pathology, and mental phenomena, are all proofs of infinite wisdom, and a divine superintendence. If fifty years ago there were few believers in this profession, it may now claim many of the most devout piety. It would be an invidious task to name those who have been distinguished, where all are so respectable.

The Arts and Sciences.—That our country abounds in inventive genius no one will question who takes a glance at the patent office. In the course of forty-three years, the length of time the patent office has been established, there have been more than seven thousand inventions recorded; and if you would say that there was much trash, it must, on the other hand, be agreed, that many things there have a claim to a high character in the Arts. Jacob Perkins invented many things which have saved the labour of many—his nail machine, and many others. Whitney's cotton gin, as was said by a learned judge, has doubled the value of every acre of land in North Carolina and Georgia. Whittemore's card-making machine was one that received from the strange man of Roanoke, an almost irreverent compliment, that it was "*like the love of God, which surpasses all understanding.*" The power looms of Stinson have been in use in every part of the country, and have saved labour to an almost incalculable extent. Look at the store-house of these models, and one could not say the inventive power of the nation has been idle.

In Mathematical science we have not been deficient; the American mind is naturally mathematical, certainly arithmetical. Many of our countrymen have been distinguished abroad for their advancement in this science. Nathaniel Bowditch, L.L.D., the author of several works on navigation, comets, and lastly, the translator and commentator of La Place, is at the head of our mathematicians. Professor Dean, Adrain, and many others, are conspicuous in this department of science. A higher knowledge of this science is now required at our colleges, and this branch is certainly much more attended to every where than formerly. It is found advantageous in the business of common life. No branch of knowledge is so easily acquired, with proper instruction, as this; yet no one gives its possessor more celebrity. Two years spent in acquiring the varieties of Greek literature would hardly advance a well bred scholar so as to be perceptible to his learned friend; but two years study in mathematicks would be very perceptible.

A slight view of our history will prove that we have been prolifick in painters, from Smybert down to the present time. West was born in the United States, but his faculties were developed in England.—Copley was a native of this country, and reached a degree of perfection in his art, before he left it, that would have made him one of the first portrait painters of any age. Hundreds of his portraits are preserved among us. Stewart returned to this country in the latter part of the last century, and for many years stood at the head of his profession, as a portrait painter. He has left numerous paintings to preserve his fame, and to show the extent of the power of his art in this line. Trumbull, the first historical painter of our country, still lives, and probably like West will die as it were with the pencil in his hand. He is as lively

as if in the noon-day of life. Vanderlyn, who gained laurels abroad, is now engaged on a likeness of Washington for the Hall of the House of Representatives, in the federal city. Dunlap is engaged as usual in instructing those of the present generation, what those of a former one suffered. The new generation of painters, Morse, Cole, Frothingham, Inman, Leslie, and many others, are busy in their calling.—There is no danger that this branch of the Arts will deteriorate in their hands.

Some few in sculpture are becoming known; Auger's Mercury, and Jeptha and his daughter, with Greenough's chanting cherubs, have already gratified the tasteful in the art; and other works are soon expected from their hands. A taste for specimens of sculpture has been awakened in this country, and we trust patronage enough to support it will follow. The fine arts are of slow growth among a people who are engaged in building up their fortunes. Monuments to departed greatness are becoming common, and artists will find employment in this branch. The monuments lately erected to Kosciusko, at West Point; to Thomas Addis Emmet, in the city of New York; to Bishop Hobart in Trinity church; are proofs that sculpture is now held in estimation. What can be more delightful to a grateful people than these memorials of genius. They are the tribute of the living, which pass not suddenly away.

Voyages and Travels.—In this department we have some valuable works. Delano's Voyages, Riley's Narrative, Lewis and Clark's Expedition to the Sources of the Missouri, Pike's expedition to the sources of the Mississippi, Major Long's expedition to the Rocky Mountains, Keating's account of Long's travels; Doctor Dwight's travels in the United States, abounding in incident, and elegant description, and containing much valuable historical knowledge: Professor Silliman has published travels both at home and abroad; he is a chaste and careful writer, who sees all things with the eye of a philosopher. Flint has given us a good account of the western country, its manners, habits, and customs. Captain Benjamin Morrell has just published an account of four voyages to various parts of the world. His book abounds in incidents, contains much nautical information, and more poetical feeling than often falls to the lot of a hardy sailor. Mrs. Abby Jane Morrell, wife of the above named Captain Morrell, was with him in his last voyage to the Southern Pacifick, and has published her narrative. It is a curious work, and shows with what intensity a woman views every novelty. She is the first female voyager from the United States who has published a journal. Bigelow has given us a volume of travels in Europe, of deep interest: he saw things as a scholar should view them, and describes with great faithfulness.

Dr. Griscom's travels are full of instruction; he went out to see and describe, and all is done in purity and honesty. His principles were too firm to be led astray by false lights of philosophy, and he had no prejudices to indulge.

Miscellaneous.—Under this head we might make a large volume without enumerating one half of those works more or less valuable; many of them of a high character. In philology, Noah Webster stands without a rival. He has spent a great part of a long life upon the subject, and if he is not without some errors and inconsistencies, they are more attributable to the nature of the science, than to the want of care, industry, or learning in him.

We are well stocked with school books, geographies, gazetteers, grammars of all sorts, and arithmeticks of all plans. In statistical works we are becoming rich. Several are labouring with assiduity in this department. The Gazetteer, by Edwin Williams, abounds in tabular information, as in other valuable matter.

In Rhetorick we have several elementary treatises, but no great work, except John Quincy Adams' Lectures on Rhetorick and Oratory, which is a work of genius and of bold opinions. He has been too much engaged in politicks these twenty years past to give them a finishing touch.

The Conversations Lexicon, printed in Philadelphia, and edited by Lieber, Wigglesworth, and Bradford, assisted, it is said, in some parts, by

Robert Walsh, has added much to the facilities of giving information on general topicks. Some of its biography, however short, is happy, and the articles in regard to the United States are written in a spirit of candour, and the information is generally drawn from good sources. This book will be extensively read, and find a prominent place in every village library. The plan is a good one, that of adding information respecting our own country to that brought from abroad, and giving, at a glance, a panoramick view of a subject. On this basis, we have treated the several parts of this work, "the Treasury of Knowledge," and on it we shall continue; our own country, always first in our affections, must not be forgotten, while we seize with avidity all that is useful from the old world. There should be a perpetual union in the republick of letters.

THE END.

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Interesting Facts in Brief.

According to the Edinburg Philosophical Journal, in Great Britain the number of individuals in a state to bear arms, from the age of 16 to 60, is 2,744,-847. The number of marriages is about 98,030 yearly; and it has been reckoned that, in 68 of these unions, there were only 3 which had no issue. The number of deaths is about 332,700 yearly, which makes nearly 25,492 monthly, 6,398 weekly, 914 daily, and 40 hourly. The deaths among the women are, in proportion to the men, 50 to 54. The married women live longer than those who continue in celibacy. In the country the mean term of the number of children produced by each marriage is 4; in towns the proportion is 7 for every two marriages. The number of married women is to the general number of individuals of the sex, as 1 to 3; and the number of married men to that of all the individuals of the male sex, as 3 to 5. The number of widows is, to that of widowers, as 3 to 1; but the number of widows who marry again is, to that of widowers in the same case, as 7 to 4. The half of the individuals die before attaining the age of 17 years. The number of twins is, to that of ordinary births, as 1 to 65. According to calculations, founded upon bills of mortality, 1 only in 3,126 attains the age of 100 years. The number of births of the male sex is, to that of the female sex, as 96 to 95.

ERDEN'S GRAND ORGAN.—Ten thousand dollars have been appropriated by the Vestry of Trinity Church towards the erection of an organ suited to the style and proportions of "New Trinity." The organ case will be 52 feet high, 27 wide, and 32 deep. The largest wooden diapason pipe will be of such dimensions, that the interior will measure upwards of 250 cubic feet. The largest metal diapason, in the centre of the front of the organ, will be five feet in circumference and 28 in length. There are to be four separate organs, known by the names of the Great organ, Swell organ, Choir organ, and Pedal organ; 43 draw stops, 11 of which will be diapasons, one 52 feet long, and four of 16 feet in length, besides two reed stops of 16 feet. Whole number of pipes 2169. Entire weight of the organ estimated altogether at 40 tons. It will be the largest organ ever erected in this country, and there are but few larger in Europe

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